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DECEMBER, 1949 Volume 20, No. 4

In This Issue

The Relationship Between Pre-Exercise Pulse Rate and Recovery Following Exercise. *Edwin R. Elbel and Robert M. Holmer* 367

Specific and Non-Specific Exercises for the Relief of Dysmenorrhea. *Josephine W. Hubbell* 378

The Major Problems of College Physical Education, 1949. *Leonard A. Larson* 387

Effect of Water Ingestion on Capacity for Exercise. *C. C. Little, H. Strayhorn, and A. T. Miller, Jr.* 398

The Development of a Test of Badminton Playing Ability. *Aileene Lockhart and Frances A. McPherson* 402

A Study of Existing State High School and Other Selected Athletic Benefit Plans. *Walter E. Marks* 406

A Survey of Teachers' Needs in Health Education, Physical Education, and Recreation. *Donovan C. Moffett* 417

An Action Current Study of Contraction-Movement Relationships in the Tennis Stroke. *Arthur T. Slater-Hammel* 424

Mental Practice and Physical Practice in Learning a Motor Skill. *Wilbur E. Twining* 432

Research Abstracts 436

Editorial Policies 442

Reprints from Past Issues 444

Life and Honorary Members 445

National, State, and Section Officers 448

Index to Volume 20, 1949 450

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The Relationship Between Pre-Exercise Pulse Rate and Recovery Following Exercise

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(Submitted for publication, September, 1948)

INTRODUCTION

IT has been well established that the normal cardiovascular system gradually adjusts itself to increased amounts of strenuous muscular activity. The immediate response to exercise of the cardiovascular system in the well conditioned person differs from the one in the individual who is not accustomed to strenuous muscular work. Likewise the circulatory system of the trained individual shows a more rapid return to the pre-exercise level than does the one possessed by the person not regularly engaging in exhaustive activity.

Since the individual known to be in good physical condition, as reflected by his ability to perform strenuous muscular activity, must possess an efficient cardiovascular system, investigators have been interested in establishing simple measures which would readily determine the presence or absence of this condition.

Many attempts were made during the recent war to establish simple methods of readily evaluating the physical condition of candidates for military service and to determine the fitness of trainees for performing military duties that demanded a high degree of physical stamina.

Of the many factors involved in the various cardiovascular tests of physical fitness, some stress has been placed upon the relationship between the pre-exercise pulse rate and recovery after exercise. This study was conducted for the purpose of securing additional data on the subject.

STATEMENT OF PROBLEM

This study was done in an attempt to determine the relationship between the pre-exercise pulse rate and the amount of time required for the pulse to return to the pre-exercise level following 2 minutes of exercise, and to determine the relationship between body weight and the amount of time required for the pulse rate to return to the pre-exercise level.

REVIEW OF LITERATURE

Cotton and Dill (4) used the cardiotachometer for determining the pulse rate during and following strenuous exercise. Their subjects were healthy young men. The exercise consisted of running on the treadmill for periods "long enough to establish a steady state" unless the subjects ran at very rapid rate. The speeds varied from 4½ miles per hour to 11 miles per hour. The pulse rate was taken for 2 periods, each 10 seconds in duration just prior to the cessation of exercise; and for 2 like periods immediately following exercise. They found that the heart rate fell on the average of one beat during the first 10 seconds following exercise and only about 6 percent in the second 10 seconds.

For the purpose of determining the post-exercise pulse rate, pulse ratio, and recovery time following exercise, Morehouse and Tuttle (12) completed a study in which they used college men as subjects. In the first two phases of their work the stool-stepping exercise and technique employed in the pulse ratio test was used. The pulse recovery time was determined following exercise with a 25 pound barbell. This weight was lifted a designated number of times (5, 10, 15, 20, or 25) rhythmically with the beat of a metronome. They found that the pulse rate for the majority of subjects returned to the pre-exercise level within 3 minutes following 5 to 15 lifts. After 20 and 25 lifts, most subjects required 9 or more minutes for recovery. The coefficients of correlation between the resting pulse rate and the recovery time following the 5 intensities of the weight-lifting exercise varied from —0.266 to +0.078. They found no significant relationship between the resting pulse rate and recovery time at any intensity of exercise. It was concluded that:

> The rate of the first few heart beats immediately following exercise is directly related to the intensity of the exercise and the resting rate.
>
> The rate of deceleration following exercise is directly related to the intensity of the exercise and the elevation of the pulse rate immediately after exercise. A very light exercise is inversely related to the resting pulse rate.
>
> The recovery time is prolonged in relation to the intensity of the exercise and is not related to the resting pulse rate.

In an attempt to determine the relationship between palmar skin resistance and pulse rate, Elbel and Ronkin (7) used a cardiotachometer to secure the pulse rate of young men during, and for 5 minutes following, strenuous exercise. These data were shown graphically in the report referred to above. For treadmill running at the rate of 7 miles per hour on a 10 percent grade the exercise period was divided into 2 parts. Each part consisted of 2 periods of running for 2 minutes, each of which was followed by 5 minutes of rest. The pulse rate was taken continuously and was recorded for each 30-second interval during the rest and exercise periods. The pulse rate at the conclusion of the second period of exercise was 172 beats

per minute. The drop in rate for the first 30 seconds following exercise was only 7 beats while the drop for the second, third, and fourth intervals was 17, 14, and 10 beats, respectively. The drop in rate for the 5 minutes following exercise was from the rate of 172 beats per minute to 108 beats for a total decrease in rate of 64 beats.

The same investigators took the pulse rate of young men during and following the knee-bend exercise. The routine for each subject was as follows: 2 periods of exercise one minute each in duration, each of which was followed by 2 minutes of rest; 2 exercise periods, 2 minutes each in length, each of which was followed by 5 minutes of rest. At the conclusion of the final period of exercise, the mean pulse rate had reached 158 beats per minute. The mean deceleration was 13 beats during the first 30 seconds of rest and 15, 8, and 6 beats for the second, third, and fourth intervals, respectively. The total drop in rate for the 5-minute period following exercise was 54 beats to a rate of 104 beats per minute. Recovery was found to be 80 percent complete during the final 5-minute rest period.

In the same study, two subjects ran on the treadmill at the rate of 6 miles per hour for 25 and 31 minutes, respectively. The pulse rate of the subject who ran for 25 minutes dropped from the rate of 182 beats per minute at the cessation of exercise to 175 beats for the first 30 seconds after exercise, to 164 beats per minute in the next 30 seconds, and to 120 beats per minute 5 minutes after exercise. The subject who ran for 31 minutes showed a pulse rate of 180 beats at the conclusion of exercise. The drop in rate was to 174 for the first 30 seconds and only to 172 the second 30 seconds and to 138 five minutes after exercise.

Brouha (2) and Brouha and Gallagher (3) used the step test in an attempt to evaluate the physical fitness of young males. Fitness to do heavy muscular work was based upon the drop in the pulse rate to certain established norms following exercise. These investigators did not use the pre-exercise pulse rate. Concerning this they made the following statement:

> The initial heart rate before exercise is started need not be taken, and furthermore, is not important. Research has shown that the initial heart rate of healthy young men does not have a significant relationship to an individual's physical fitness; his fitness depends upon the rate at which the heart slows after exercise . . .

Karpovich, Starr, and Weiss (9) used a table of norms for deceleration of pulse rate following exercise for determining the physical fitness of convalescent patients in AAF hospitals.

Elbel and Green (6), Miller and Elbel (11), and Beecher (1) found that, on the average, the post-exercise pulse rate fell slightly below the pre-exercise rate 1½ minutes following moderate exercise.

This was not the case with the more strenuous work. However, on the average, the pulse rate returned to within 10 beats of the pre-exercise level within 1½ minutes after exercise.

Master and Oppenheimer (10) used men and women subjects to determine the response of the heart to exercise. The work was done on an especially constructed device for mounting two steps and returning to the floor a variable number of times. Pulse rate and blood pressure of each subject were taken prior to and following exercise. Relative to the relationship to work and body weight they came to the conclusion that the relation between work and weight is expressed by a straight line. Work capacity for the most part is in direct proportion to increasing weight. According to their findings, after 160-165 pounds in men and 135-145 pounds in women there is a marked fall in the curve. Apparently, subjects at these weights are more efficient.

In considering weight in relation to the before-exercise pulse rate and the rate following bouts of mild, moderate, and strenuous exercise, Elbel (5) found there was an insignificant coefficient of correlation between the pre-exercise pulse rate and weight. The coefficient of correlation between weight and the amount of increase in pulse rate due to exercise was also found to be insignificant.

Henry and Kleeberger (8) considered that weight played an important part in cardiac response because of the additional work required by heavier persons.

PROCEDURE

Forty-five healthy male students at the University of Kansas were used as subjects for this study. The group contained varsity athletes and students majoring in physical education who were regular participants in physical activity classes. The group could be considered better-than-average in physical fitness.

Each subject rested in a recumbent position until the radial pulse became stabilized (until 3 identical readings were secured successively). The pre-exercise pulse rate was then recorded.

Following this, the step-up exercise was demonstrated, after which the subject engaged in a period of exercise 2 minutes in duration at a cadence of 36 steps per minute. A step 16 inches in height was used. The cadence was set by an electric metronome and the timing was done with a stop watch. Upon the completion of exercise, the subject immediately assumed a recumbent position and remained in this position until his pulse rate returned to the pre-exercise level. Beginning 5 seconds after the cessation of exercise, the pulse rate was recorded during 2 periods, each 15 seconds in duration. Starting one minute after exercise and each minute thereafter for the first 10 minutes, the pulse rate was secured during a period 30 seconds in length. Following this, the pulse rate was secured during periods 30

seconds in duration every 2 minutes until the pulse had reached the pre-exercise level.

For the purpose of comparing weight with recovery time, the weight of each subject was recorded prior to exercise.

DATA

The raw data consisted of:

1. The pulse rates taken with the subject in a recumbent position as follows:

a. Prior to exercise.

b. The pulse rate counted for 2 periods 15 seconds in duration beginning 5 seconds after the cessation of exercise.

c. The pulse rate secured for a period of 30 seconds starting one minute after exercise and each minute thereafter for the first 10 minutes and for 30 seconds every 2 minutes thereafter until the pulse rate returned to the pre-exercise level.

2. The weight of each subject.

The means, standard deviations, and standard errors were computed by standard statistical procedures. The coefficients of correlation were determined by the Pearson Product Moment Method.

The mean pulse rate prior to exercise was 68.94 beats per minute. The mean pulse rate taken for the 15-second period starting 5 seconds after the cessation of exercise was 149.6 beats per minute. The mean increase over the pre-exercise pulse rate was 80.66 beats per minute. The mean pulse rate for the 15 seconds starting 20 seconds after exercise showed a deceleration in rate of 15.2 beats per minute under the rate for the first pulse period. The pulse taken for 30 seconds beginning one minute after the cessation of exercise showed a deceleration in rate of 41.8 beats per minute from the rate secured during the period from 5-20 seconds after exercise. The rate for the period from 2 minutes to 2 minutes, 30 seconds, following exercise was 52.0 beats less than the first reading following exercise. The period from 3 minutes to 30 seconds after the initial reading showed that the combined drop in rate was 57.30 beats per minute. In other words, within 3½ minutes following exercise the pulse recovery was 74.6 percent complete. The mean recovery time was found to be 27 minutes with a range from 8 to 34 minutes.

It is interesting to note that the smallest standard deviations and standard errors were found for the period between 5 and 20 seconds and the period from 20 to 35 seconds following exercise (Table I). The standard deviation for the period from one minute to one minute and 30 seconds shows the largest variation of the post-exercise findings. From this period there was a relatively uniform decline in the size of the standard deviations until the period 30 minutes after exercise.

TABLE I

MEAN PRE-EXERCISE PULSE RATE; MEAN INCREASE FOLLOWING EXERCISE; MEAN DECELERATION IN RATE FROM PRECEDING READING; STANDARD DEVIATIONS; AND STANDARD ERRORS

Elapsed Time Following Exercise	*Number of Subjects*	*Mean Pulse Rate*	*Standard Deviation*	*Standard Error*	*Mean Increase Over Resting*	*Total Decrease from 1st Post-Ex. Rate*	*Mean Decrease from Preceding Period*
Resting	45	68.94	9.73	1.47			
5–20 Sec.	45	149.60	3.25	.48	80.66		
20–35 Sec.	45	134.40	3.43	.52	65.46	15.20	15.20
1 Minute	45	107.80	8.86	1.32	38.86	41.80	26.60
2	45	97.62	7.77	1.17	28.68	52.00	10.18
3	45	92.30	6.52	.99	23.36	57.30	5.32
4	45	90.00	5.84	.88	21.06	59.60	2.30
5	45	88.40	5.62	.84	19.46	61.20	1.60
6	45	87.16	5.55	.83	18.22	62.44	1.24
7	45	86.64	5.73	.87	17.70	62.96	.52
8	45	85.28	5.25	.79	16.34	64.32	1.36
9	45	84.32	5.06	.76	15.38	65.28	.96
10	44	81.50	4.98	.76	12.56	68.10	2.82
12	44	81.44	5.01	.77	12.50	68.16	.06
14	44	80.09	4.57	.70	11.15	69.51	1.35
16	44	78.00	4.57	.70	9.06	71.60	2.09
18	43	77.16	4.66	.72	8.22	72.44	.84
20	39	77.78	4.45	.73	8.84	71.82	—.62
22	37	75.30	4.65	.78	6.36	74.30	2.48
24	33	74.00	4.75	.84	5.06	75.60	1.30
26	28	73.14	4.68	.91	4.20	76.46	.86
28	20	71.40	4.21	1.03	2.46	78.20	1.74
30	14	69.52	3.58	1.00	.58	80.08	1.88
32	7	70.48	4.06	1.66	1.54	79.12	—.96
34	5	70.16	4.96	2.48	1.22	79.44	.32

Figure 1 shows the mean deceleration in pulse rate through 22 minutes. The total time for recovery for all subjects was not used since there would be a distortion in the graph due to the decrease in the number of subjects.

In order to determine the relationship between recovery time and other variables involved in the study, the following coefficients of correlation were calculated:

1. Between recovery time and the pre-exercise pulse rate, $+0.164 \pm .146$.
2. Between body weight and recovery time, $+0.087 \pm .149$.
3. Between the pulse rate taken from 5 to 20 seconds following exercise and recovery time, $+0.213 \pm .143$.
4. Between the pre-exercise pulse rate and the pulse rate taken from 5 to 20 seconds following exercise, $-0.201 \pm .144$.

None of the coefficients of correlation was found to be significant.

DISCUSSION

Cotton and Dill found only one beat in deceleration in pulse rate during the first 10 seconds following exercise and only a 6 percent drop during the second 10 seconds. In the present study, the deceleration was rapid in that there was a mean decrease of 15.20 beats in the 15-second period from 5 to 20 seconds after exercise. The rate per minute dropped from 149.6 to 107.8 within one minute and 30 seconds after exercise. The work done in the study by Cotton and Dill (4) was no doubt much more strenuous than in the present study. The difference in strenuousness of the activity may have been responsible for the difference in findings.

Elbel and Ronkin (7) found corresponding rates of deceleration following treadmill run and knee-bends (172 to 108 and 158 to 104, respectively). In their data it was noted that the decline was more rapid during the second 30 seconds following exercise than during the 30 seconds immediately after exercise.

Morehouse and Tuttle (12) used normal male subjects in a study involving the lifting of a 25-pound weight from 5 to 25 times per minute. It was found that regardless of the intensity of exercise the correlation between recovery time and the pre-exercise pulse remained insignificant. The exercise used in this study is believed to have been more strenuous than that used by Morehouse and Tuttle. The coefficients of correlation between the pre-exercise pulse rate and recovery time obtained by those investigators varied from -0.266 to $+0.078$. These results compare favorably with the coefficient of correlation of $+0.164$ secured in this study.

With the pulse rate taken with the subjects in a sitting position, Elbel (5) secured a coefficient of correlation of -0.342 between the pre-exercise pulse rate and the increase in rate due to 2 minutes

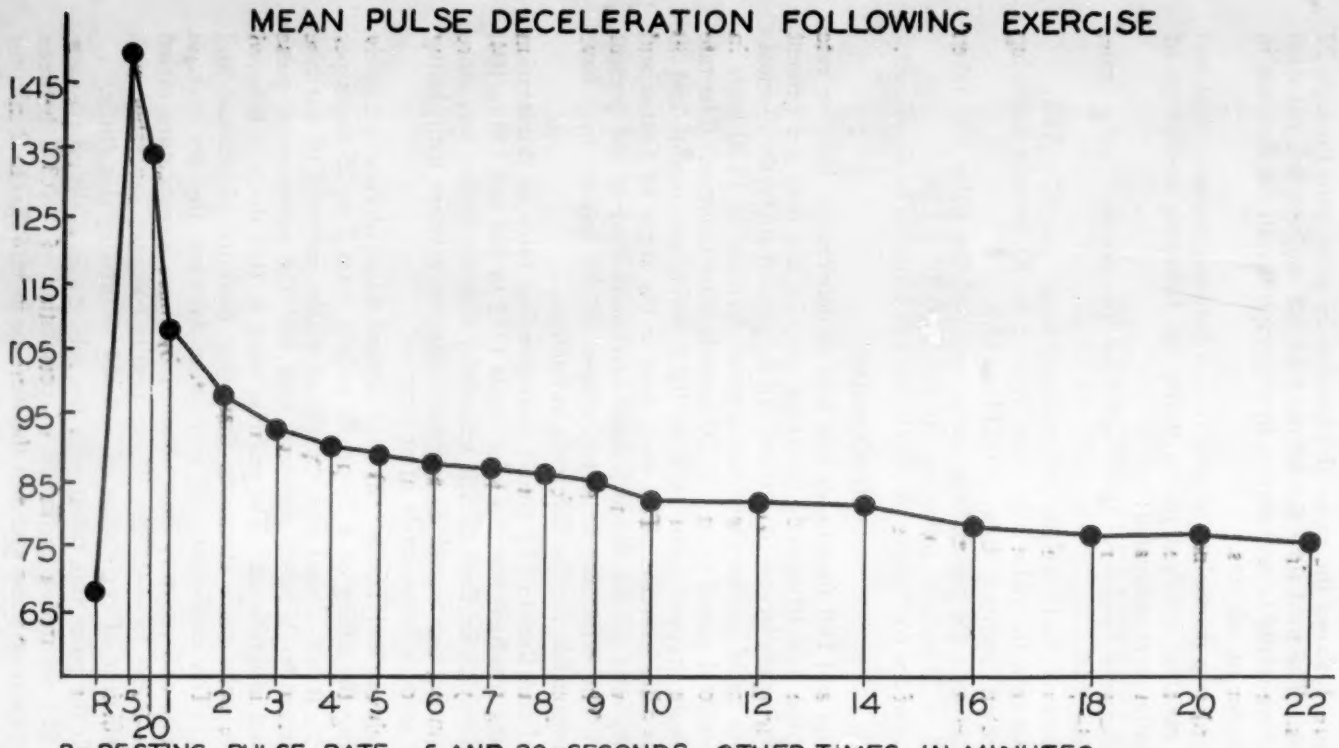
MEAN PULSE DECELERATION FOLLOWING EXERCISE
145
135
125
115
105
95
85
75
65
R 5 20 1 2 3 4 5 6 7 8 9 10 12 14 16 18 20 22
R=RESTING PULSE RATE. 5 AND 20=SECONDS. OTHER TIMES IN MINUTES.

Fig. 1.

of step-up exercising at the rate of 36 steps per minute. In the present study, the coefficient of correlation between the pre-exercise pulse rate and the increase in rate following comparable work was −0.201.

Elbel (5) found an insignificant coefficient of correlation between weight and the pre-exercise pulse rate and between weight and the increase in pulse rate due to exercise. In the present study an insignificant coefficient of correlation of +0.087 was secured between weight and recovery time. Master and Oppenheimer (10) stated that work and weight could for the most part be expressed in a straight line, and that work capacity rises in direct proportion to increasing weight to 160-165 pounds for men and 135-145 pounds in women. However, it is to be recalled that only male subjects were used in the present study and the one conducted by Elbel, and in each case they could have been considered in "better-than-average" physical condition. Considering the data, it can be concluded that, for subjects of this type, the additional foot-pounds of work performed by heavier subjects while doing the step-up exercise does not cause an abnormal influence upon the pulse reaction as compared to the reaction of lighter subjects.

The data contained in Table I show the largest standard deviation for the resting pulse rate and relatively small standard deviations for the first and second periods during which the pulse was taken following exercise. The second largest S. D. was found for the period from one minute to 1½ minutes after exercise. Following this there was a relatively uniform decline in the size of the standard deviations. This would seem to indicate that, for subjects of this type, the rating of subjects as to physical fitness based upon pulse recovery should be considered as relative rather than absolute within narrow limits.

SUMMARY AND CONCLUSIONS

In this study 45 healthy male university students performed the step-up exercise at a cadence of 36 steps per minute for a period of 2 minutes. Pulse rates, with the subject in a recumbent position, were secured prior to exercise and at uniform intervals following exercise until the pulse rate had returned to the pre-exercise level. Comparisons were made between (a) the pre-exercise pulse rate and the amount of time required for the pulse to return to the pre-exercise rate, (b) body weight and the amount of time required for the pulse rate to return to the pre-exercise rate, (c) the increase in pulse rate immediately following exercise and the recovery time, and (d) the pre-exercise pulse rate and the pulse rate taken for a period of 15 seconds immediately after exercise.

The mean pre-exercise pulse rate was found to be 68.9 beats per minute. The mean pulse rate taken for the period from 5 to 20 seconds following exercise was 149.6 beats per minute. The mean increase in pulse rate was 80.66 beats per minute. The deceleration in pulse rate following exercise was rapid. The drop in rate was 15.2 beats per minute for the period from 5 to 20 seconds following exercise. The mean rate for the pulse 1½ minutes after exercise was 41.8 beats per minute and 57.3 beats per minute 3½ minutes after exercise. The mean recovery time was 27 minutes. On the basis of the data, it was concluded that:

1. Recovery time is not related to the pre-exercise pulse rate as evidenced by the fact that the coefficient of correlation between the pre-exercise pulse rate and amount of time required for the post-exercise pulse to return to the pre-exercise level was found to be insignificant (+0.164).

2. Body weight is not related to the amount of time required for the return of the pulse to the pre-exercise rate as shown by the insignificant coefficient of correlation (+0.087).

3. The pre-exercise pulse rate and the increase due to a 2-minute period of exercise are not related as shown by the insignificant coefficient of correlation of —0.201.

4. There is an insignificant coefficient of correlation between the pulse rate taken for 15 seconds immediately following exercise and recovery time (+0.213).

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Specific and Non-Specific Exercises for the Relief of Dysmenorrhea

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(Submitted for publication, January, 1949)

INTRODUCTION

THE monthly period of menstruation seems to present the problem of dysmenorrhea to a large number of girls and women. Since there are so many confronted with the more or less debilitating effects of painful menstruation, the problem deserves continued and careful study to determine a satisfactory and reliable means of relieving this condition.

The existence of such a condition as dysmenorrhea has been recognized since antiquity. Countless theories, dogmas, prejudices, and superstitions have evolved around it, many without the slightest consideration for scientific or logical reasoning.

In more recent times the medical profession has attacked the problem with somewhat more success. Drawing upon the accumulated wealth of knowledge about the functionings of the human body, it has offered *reasons* for the presence of dysmenorrhea in some instances. As a means of relief, gynecologists have offered medication, surgery, and exercise. Also contributing to a reduction of the presence of dysmenorrhea has been the psychic factor which became quite evident during World War II, when women in industry found it no longer wise or desirable to be absent from work because of the heretofore accepted excuse of "monthly illness" (3). Each has met with varying degrees of success. None of these means has proved preeminently successful, however, for today dysmenorrhea is still prevalent among high school and college girls and women in business, industry, and the home.

More recent than the attack of medicine upon the problem of dysmenorrhea has been the increasing interest in the problem shown by women in the field of physical education. Theirs has been an interest born of close association with girls and the constant consideration of the health and conditioning of girls. Following the beginning made by the medical profession they have subscribed to a few selected exercises for the relief of dysmenorrhea. Up to the present time only a little work has been done to determine which exercises seem to be best, or why some exercises are better than others. During

the recent war Billig (1) presented an exercise designed to relieve dysmenorrhea. He justified this exercise by an analysis of the causes of dysmenorrhea and the correcting effect his exercise had upon this condition. More recently Lundquist (2) has conducted further research on the problem.

Some questions to be answered are:

1. What essential elements seem to be found in those exercises which give some degree of relief?
2. Is the psychic factor centering around the knowledge that exercises are being performed for a specific reason, and that therefore anticipated, favorable results, effective for securing relief, will follow?
3. Can improvement of such a physiological condition as dysmenorrhea be expected from a set of general exercises?

We in physical education should do everything possible to build up accurate and measured evidence of the results of various exercises upon the condition of dysmenorrhea in an effort to ascertain insofar as possible which kinds of exercises seem to give definite and consistent relief. It is with this object in view that this study is presented.

PROCEDURE

This study was conducted at the State University of Iowa during the year 1947-1948. It was carried on over a period of twenty weeks with a discontinuance of eighteen days during the Christmas holidays. This interruption occurred at the end of the sixth week of the study. The subjects were girls drawn chiefly from the freshmen classes of the Liberal Arts College and the School of Nursing who volunteered their services because of their interest in securing relief from dysmenorrhea by means of exercise.

The materials presented to the volunteer subjects and the manner of collecting the data were substantially the same as used in the Lundquist study and reported in an earlier issue of the *Research Quarterly* (2). Exercises for Group I and Group II were the same as used by Lundquist (2), i.e., the Billig exercise and the more or less traditional type of exercises for dysmenorrhea including the Mosher exercise. The subjects in Group III did a series of four exercises designed for general body improvement but carefully selected by the writer for their expediency in avoiding as far as possible the direct use of abdominal muscles, which feature characterized the other exercises.

Directions for Exercises for Group III

All counts referred to in the exercises are timed approximately one count to one second.

1. *Trunk Twisting.*—Stride standing, one hand on hip. Fling other arm from a position in front of body obliquely upward and backward allowing trunk to rotate with the arm movement. The eyes should

follow the hand as it describes an arc through the air. Do this exercise eight times to each side.

2. *Hip Flexion.*—Standing feet parallel, do a deep knee bend allowing hands to touch floor in front of feet. Raise hips by straightening knees and hold for one count, keeping hands on floor, then return to starting position. Do this to four counts. Do this exercise five times.

3. *Trunk Extension.*—Sitting on heels (toes pointed backward) knees on floor, chest on knees, and hands clasped behind back. Raise upper part of body by arching back and thrusting hands backward to two counts and lower to two counts. Keep head fixed by looking at the floor throughout the exercise. Do this exercise eight times.

4. *Side Stretching.*—Sitting cross legged, left hand tucked well against side of upper ribs (back of hand pressing against ribs) and right arm curved up over head. Bend on four counts to the left (a bobbing motion), return to starting position and repeat. Do this exercise to each side two times.

The exercises were presented to the girls in all groups as a means of gaining relief from dysmenorrhea. They were explained and demonstrated to small groups and each girl was individually checked for correctness of performance at the beginning of the study and again about two weeks later.

ANALYSIS OF DATA

Data were studied on records submitted by fifty-three subjects who performed the prescribed exercises over a period of twenty weeks. These subjects were divided as follows: sixteen in Group I, sixteen in Group II, twenty-one in Group III. There was some irregularity in number of times of performing the exercises, but the more irregular subjects were almost evenly distributed through the three groups, so that the groups remained evenly equated regarding the factor of irregularity of performance.

During the Christmas holiday recess some subjects continued daily with their exercises. When these cases were checked after the first of the year to determine any noticeable improvement in their conditions, there was nothing to indicate that they were responding to the exercises as a group any differently from the subjects who lapsed from their daily routine. This lack of difference can probably be attributed to the fact that this period came relatively early in the study.

Some recognition should be given for inconsistencies in reporting information, even though the importance of careful recording of necessary information was indicated to the subjects. It must be remembered that much of the information is derived from subjective judgment on the part of the subjects.

Where results are indicated for the final menstrual period, this refers to the last period of the study, whether it be the fifth, fourth, or even the third period. This method of reporting results would seem to give a better indication of changes undergone during the study than an arbitrary comparison of the first period with the fourth or fifth menstrual period. This makes possible an approximate agreement in length of time elapsing between the initial and final periods.

Indications of Symptoms.—Table I reveals the following pertinent facts concerning symptoms. Of the factors accompanying the menstrual periods (headache; depressed feeling; irritability; general body weakness; nausea; chills; constipation; pain in lower back, abdomen and legs), general body weakness, irritability, and depressed feeling, in that order, were the most frequently indicated factors during the initial periods. During the final period all items remained the same in order of frequency, except in Group III headache superseded irritability in total number of occurrences.

TABLE I

INDICATION OF FACTORS PRESENT DURING MENSTRUAL PERIOD

	Group I		*Group II*		*Group III*	
	Initial Period	*Final Period*	*Initial Period*	*Final Period*	*Initial Period*	*Final Period*
	N %	*N* %	*N* %	*N* %	*N* %	*N* %
Headache	6 38	4 25	5 31	5 31	6 29	4 19
Depressed Feeling	8 50	7 44	9 56	6 38	11 52	6 29
Irritability	9 56	6 38	10 63	6 38	11 52	3 14
General Body Weakness	13 81	6 38	7 44	6 38	13 62	8 38
Nausea	3 19	1 06	2 13	2 13	4 19	0 0
Chills	7 44	3 19	5 31	1 06	8 38	2 10
Constipation	4 25	3 19	4 25	1 06	8 38	3 14
Pain in: Lower Back	8 50	7 44	7 44	4 25	11 52	7 34
Abdomen	11 69	10 63	11 69	8 50	16 76	12 57
Legs	5 31	2 13	4 25	2 13	6 29	1 05
Forced to Bed	5 31	5 31	5 31	3 19	4 19	5 24
Drugs	9 56	5 31	5 31	6 38	11 52	9 43
Heat	5 31	4 25	3 19	2 13	8 38	2 10

All but five factors in all groups showed a decline in frequency of occurrence during the time between the first and last menstrual periods. In Group II the incidence of headache and nausea was equal in the first and last periods, and in Group I the same number indicated they were forced to go to bed during the initial and during the final periods. In Group II during the final period one more subject indicated the use of drugs than during the initial period, and in Group III one more subject indicated that she was forced to go to bed. Regarding this last point, it would seem that habit may be offered as a reason for there being the same number indicating "forced to bed" in Group I. However, close examination of the data reveals that in three of the five cases in Group I and in four of the five cases in Group III of the subjects checking that factor for the last period,

the subjects were not the same ones as those checking it for the first period.

Significant decreases in percentages are revealed in each group as follows: There was a 100 percent reduction in nausea between the first and last periods in Group III. Also in Group III, irritability, chills, pain in legs, and use of heat were reduced by 73 percent or more. In Group II chills and constipation showed a reduction of 80 percent and 75 percent respectively. The percentages of reductions in Group I were not as pronounced, since there were only four symptoms, nausea, chills, pain in legs, and general body weakness, having a reduction of over 50 percent. Looking at all groups, the greatest percentage of decrease was shown in the symptom of chills.

In analyzing the differences, if any, between the mean frequencies of number of symptoms of dysmenorrhea checked for each period in each group, it was found that no period of a particular group differed significantly from any period of either of the other groups when the "t" test was applied. This would seem to indicate that no set of exercises was superior to the others in inducing an appreciable reduction in symptoms manifested at the time of menstruation during this study.

An analysis was made to determine whether or not the difference between the mean frequencies of number of symptoms of dysmenorrhea checked during the first and last periods in each group was significant. It was found that Group I yielded a chi-square between the first and last periods of 5.76, Group II, a chi-square of 4.84, and Group II, a chi-square of 15.86. From this it would seem that the subjects in all groups showed improvement between their first and last menstrual periods to a greater degree than can be attributed to chance, and that the subjects in Group III showed the greatest improvement during the course of the study as indicated by various symptoms at the time of menstruation.

Participation in Activities.—It is interesting to note the almost universal participation of the population in some activity at least during one menstrual period. Only six subjects indicated no activity. This would seem to be, generally speaking, an excellent commentary on the improved thinking that has been in progress for the past several years regarding the matter of activity during menstruation.

Length of Periods and Degree of Pain.—The periods ranged in length from three to eight days. The most commonly indicated number of days for the duration of the initial period was six. This length was reported by nineteen subjects or 36 percent of the total group. The greatest number of subjects, twenty-two or 42 percent, indicated five days as the length of the final period. This general decrease in length of periods is reflected through all groups, since there were only six subjects at the end of the study indicating more

than six days of menstrual flow. This finding is in agreement with the Lundquist study (2). The mean number of days of the menstrual period for all subjects for their first period during the study was six days. This was decreased to a mean number of 5.4 days.

The day on which pain occurred ranged from the day before menstruation through the fourth day of menstruation. The first day of the period was the time most often indicated as the day during which pain occurred. The number of subjects indicating the first day increased in each group in the final period over the initial period. There were eight in the initial period in Groups I and III, increasing to ten and eleven respectively in the final period and five in Group II increasing to ten. Six, five, and seven in Groups I, II, and III respectively indicated more than one day of pain during the initial period, while these figures were reduced to two, zero, and two in each group respectively for the final period.

The increased number of subjects indicating pain the first day and the decrease in number indicating more than one day of pain, together with the increase in number indicating no days of pain, are all indicative of a decreasing and a localizing of the time of pain accompanying menstruation. The greatest improvement in this factor occurred in Group II where ten subjects indicated pain the first day and the other six in the group indicated no pain.

The hours of pain* during the menstrual periods were indicated as follows: during the initial period one in each of Groups I and III indicated three days of pain. At the lower extreme a total of eight subjects indicated no pain. Twenty subjects, or 38 percent, indicated pain of ten or fewer hours' duration, and ten, or 19 percent, claimed pain for one day. During the final period nineteen, or 36 percent, indicated no pain, and nineteen indicated five hours or less of pain. This shows a favorable response to the exercises from all groups in point of reducing the amount of pain endured during a menstrual period. The subjects in Group II indicated less pain on the whole than those in the other groups. However, those in Group I showed the greatest reduction in pain between the initial and final periods.

The matter of degree of pain was of necessity arrived at subjectively, although a uniform pattern of degree of intensity was suggested to all subjects when the checking of severe, moderate, and mild pain was explained. Considering the severity of pain, the greatest reduction was to be found in Groups I and III. In the latter the number of subjects designating pain as severe was decreased from four to one subjects, or 75 percent, and from five to two subjects, or 60 percent, in these groups respectively between the first and last periods. There was greater reduction in Group II under the classi-

* Pain was to be indicated as a localized feeling of discomfort or cramps in the abdomen, lower back, or pelvic region.

fication of moderate, as there was a decrease from eight to four subjects, or a 50 percent reduction. Also in Group II there was a substantial increase in number of subjects reporting mild pain. These figures changed from one to six, or an increase of 83 percent.

There was an increase in all groups in the number of subjects reporting no pain during the last periods of the study. The greatest increase was in Groups I and III where the number of subjects increased from one to five, or 80 percent, and from three to seven, or 57 percent, respectively. From these figures there would seem to be an indication that the figures remained more static in Group II with Groups I and III showing both greater range and greater improvement.

Daily Performance of Exercises.—The genuine interest with which the majority of the subjects followed the study would lead the writer to believe that the reports on the daily performance of the exercises are comparatively free from error or overstatement.

Seven subjects, or 34 percent of Group III, reported that they did not miss a single performance of exercises during the 140 days of the study.* Neither of the other groups approached this figure of perfect performance. In Group III 48 percent did the exercises all but three or fewer times during the study. In Group III one subject missed as many as thirty-nine days in performance of exercises, and six subjects, or 30 percent, reported misses ranging from thirteen to thirty-nine times.

In Group II one subject missed as many as thirty-six days and five subjects, or 31 percent, missed between thirteen and thirty-six times. The performance of those in Group I seems to be less inclined towards extremes, there being three subjects missing one day or less and four subjects missing over twenty days, while five subjects, nearly one-third of Group I, missed between sixteen and twenty-one days in performance.

These findings would seem to indicate that if regularity of performance of exercises throughout the total length of the study is a contributing factor, Group III should probably show better results as a whole.

Results of Questionnaire.—A questionnaire was given to all subjects just before the close of the study. The purpose of this questionnaire was to obtain a subjective evaluation of the study made by the subjects themselves. It is interesting to note that in most cases those subjects who indicated on their monthly records some improvement during the study and who applied themselves faithfully to the exercises were the ones who indicated benefit from the exercises. On the

* These figures do not take into account the variations in performance of exercises during the Christmas holidays.

other hand, those who were remiss in the matter of performing the exercises, and who did not seem to indicate improvement from month to month, indicated no benefit received from the study. Not all questionnaires were returned. One subject from Group I, five from Group II, and three from Group III failed to return them. Of those who returned questionnaires, all but eight indicated some benefit gained from the work.

There was an almost even distribution between the three groups of those indicating a desire to continue with the exercises beyond the duration of the study and those not wishing to continue. The number who wished to continue was slightly greater than the number who wished to stop the exercises.

Of interest were the answers to the question concerning the performance of exercises for dysmenorrhea before the study. Only five indicated that they had ever before done such exercises and none of those five indicated that any relief had been obtained. Of those who had performed exercises previously, three subjects had done the Billig exercise, one had done a set of general exercises, and one had done the Mosher exercise.

The chief value of the questionnaire was that the subjects themselves expressed an opinion as to the value of the exercises to them.

CONCLUSIONS AND RECOMMENDATIONS

The following conclusions may be drawn from the data presented in this study.

1. Exercise taken with the expectation of reducing the incidence of dysmenorrhea has a favorable effect.
2. It cannot be determined from this study whether the relief from dysmenorrhea obtained by the subjects performing the general exercises (Group III) is the result of a generally improved condition of physical fitness; or the result of a psychic factor because the subject knew that something was being done to remove the condition of dysmenorrhea.
3. No group of exercises was superior to the others in inducing a reduction of dysmenorrhea.
4. General exercises seem to have as much or more effect in reducing dysmenorrhea as the exercises specially designed for this purpose.
5. There was a tendency towards normalization of function as indicated in a decrease for many subjects in the length of the menstrual period and a restriction in all groups of the time of pain to the first day of the menstrual period.
6. According to the subjective judgments of the subjects, there was an indication of a lessening of the number of hours of pain at the time of menstruation. Group II indicated less pain throughout the

study than the other groups. Group I indicated the greatest reduction in pain between the initial and final periods of the study. Severity of menstrual pain was decreased in all groups, and there was an increase in the number of subjects in all groups reporting no pain at the end of the study.

7. A large percentage of the subjects were of the opinion that they had benefited from the study.

8. Interest in performing the exercises was greater among the severe cases of dysmenorrhea than among the mild cases.

In the light of the present findings the following recommendation is suggested: The three types of exercises employed in this study gave a noticeable measure of relief from dysmenorrhea to the majority of the subjects performing them; therefore, there would seem to be an indication that exercises oriented toward the relief of dysmenorrhea should be encouraged.

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The Major Problems of College Physical Education, 1949

Prepared by the

COMMITTEE ON COLLEGE PHYSICAL EDUCATION PROBLEMS
LEONARD A. LARSON, CHAIRMAN
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(Submitted for publication, August, 1949)

IN 1947 the Research Committee of the College Physical Education Association was reorganized into the Committe on Problems in College Physical Education. The purposes of this committee are to determine the major problems in college and university physical education and to initiate steps for their solution. During the past two years this Committee has identified some eighty problems which college physical education should meet. Many of these problems are not unique to the college field but are common to physical education in public school and related areas. Some of these can be solved through research, others through group discussion and action at local, state, and national levels.

These problems have been discussed at the College Physical Education Association meetings and circulated to institutions in the United States conducting graduate programs in the field. The problems are listed below and classified by areas. It is hoped that, if any institution is working toward the solution of any of these problems, the area chairman or the committee chairman will be notified.

INTERPRETATIONS AND OBJECTIVES

DAVID K. BRACE
University of Texas
Austin, Texas

1. *Platform of Objectives:* The preparation and uniform adoption of a platform of simple and sensible objectives covering all phases of college physical education.

2. *Knowledge of Objectives by Professional Staffs:* The need for more effectively acquainting professional workers in college physical education with the general objectives of the total program and with the more specific purposes of each phase of the program through pre-service and in-service educational procedures.

3. *Indoctrination of Students in Objectives:* The need for indoctrinating all college students with the objectives and nature of college physical education so that students will leave college with a comprehensive understanding of the total program and not merely

limited impressions of that part of the program which they experienced.

4. *Endorsement of Objectives by Related Professional Groups:* The need for interpreting to and securing the endorsement of our objectives and program by related professional groups and organizations.

5. *Interpretation of Objectives to the Public:* The need for interpreting the purpose and nature of college physical education to the public through graphic and appealing media.

MEASUREMENT AND EVALUATION

H. Harrison Clarke
Springfield College
Springfield Massachusetts

6. *Factors for Measurement on the College Level:* Careful consideration and study of the important factors which the physical educator should measure on the college level.

7. *Tests for Measurement of Physical Fitness:* Selection and simplification of tests to measure physical fitness (physical conditioning).

8. *Careful Evaluation Aiming at Selection of Tests which Best Measure Social and Personality Traits:* These tests should be of value to physical education personnel when seeking to measure student achievement and progress.

9. *Need for Tests in Various Physical Education Activities:* The need for valid and reliable skill tests in the various physical education activities with appropriate norms.

10. *Use of Test Results:* Study of the proper use of tests results, especially in guidance and program planning.

1. *Grading in Physical Education:* Determination of acceptable criteria to serve as the bases for awarding grades in physical education. There is a great need for guiding principles and procedures in determining student grades in physical education.

PROGRAM: PHYSICAL EDUCATION AND HYGIENE

J. W. Kistler
Louisiana State University
Baton Rouge, Louisiana

12. *Determination of the Relative Worth of Various Physical Education Activities:* A study of the relative worth of the various activities of the physical education program in relation to objectives.

13. *Selection of Materials for College Hygiene Courses:* A study of the materials that are most worthwhile or most pertinent to college students in hygiene service courses.

14. *Provision for Individual Needs and Interests in Physical Education:* A study of the individual growth and development needs at the various age levels and the manner in which physical education can make the optimum contribution to these needs.

15. *The Use of Teaching Aids:* There is need of a study to determine criteria for the selection and methods of using various kinds of teaching aids available which are most appropriate to courses in physical education and hygiene.

16. *Integration of Instruction in Physical Education and Hygiene:* A study is needed to determine effective methods of integrating instruction in physical education and hygiene.

17. *Standards of Proficiency in Physical Education:* The establishment of standards of proficiency to serve as a basis for grading in physical education.

PROGRAM: ATHLETICS

LOUIS F. KELLER
University of Minnesota
Minneapolis, Minnesota

18. *Professionalism in College Athletics:* Careful studies need to be made to determine the manner in which the amateur status of college athletics may be preserved. These studies should cover such important matters as athletic scholarships, recruitment, subsidization, and proselyting of athletes and other practices which endanger amateur standing.

19. *Sportsmanship in College Athletics:* Studies are needed to determine the manner in which sportsmanship at college athletic events may be improved among students and other spectators. The causes of "booing" and other discourteous types of behavior should be carefully investigated. Perhaps studies in this area may be done in collaboration with social psychologists.

20. *Gambling and College Athletics:* Studies should be initiated to determine how gambling in connection with college athletics might be eliminated.

21. *Cooperation Between Coaching and Teaching Staffs:* Suggestions are needed which may help to bring about more effective cooperation between coaching and physical education staffs. In many institutions there exists a great gap between the personnel responsible for these functions. Policies and procedures are needed to serve as guides so that both of these groups may cooperate to the fullest extent for an effective total program.

22. *Physiological Aspects of College Athletics:* More evidence of the physiological aspects of college athletics is needed. Such questions as the physiological effect of strenuous sports upon an individual both during and after competition need to be answered.

Other problems such as the nature of staleness, making weight for such sports as boxing and wrestling, and developing and maintaining peak conditions for competition purposes, need exploring.

23. *Financing the Athletic Program:* More evidence is needed upon some of the problems related to the financing of intercollegiate sports. Questions of policy arising from the support of the intercollegiate program, from gate receipts, student fees, general college budget and other sources, need answering.

24. *Scope of the Athletic Program:* The desirability of including certain sports such as boxing in the intercollegiate program, have been questioned by many. A thorough study of what sports might be included and the conditions under which students be allowed to participate, needs to be undertaken.

ADMINISTRATION: ORGANIZATION AND STAFF

WYNN FREDERICKS
University of Southern California
Los Angeles, California

25. *Specialization within the Physical Education and Athletic Division:* There are many ideas regarding the organization of the athletic and physical education division. National studies should be undertaken to determine what is the most common type of organization. These studies should seek the answer to certain questions. Should there be separate staff and divisional heads? Should specialists be restricted in their teaching to one particular department of the division? How specialized should certain staff members become?

26. *Graduate Assistants as Teachers of Classes:* More agreement is needed upon the place of graduate assistants in departments of physical education. Certain questions of policy regarding their use need answering. Should large numbers of graduate assistants be used in place of permanent staff members in the service curriculum? Should any limitations be placed upon the level at which graduate assistants teach? How many years should graduate assistants be permitted to stay in a department?

27. *Athletic Coaches and the Teaching of Classes in Physical Education:* One of the most persistent problems of departments has been related to the matter of coaches teaching physical education classes. Questions needing more understanding are: Should coaches be scheduled for such classes when their sports are in season? Should there be any limitation placed upon the number of hours coaches may teach either in or out of their season? During the time when coaches must miss service classes, how may substitute teachers be best provided? When problems arise which require administrative action, under whose jurisdiction do coaches fall?

28. *Advanced Degrees as a Major Criterion for Election to a University Staff:* In recent years, the amount of graduate work in physical education has increased tremendously. Studies might be made to determine the relationship of graduate education to the effectiveness in teaching and coaching. For instance, should advanced degrees be a major criterion for election to a university staff? Have advanced degrees been of primary importance in improving the teaching effectiveness of personnel? Finally, have advanced degrees been of any significance in improving the status and financial income of those holding such degrees?

29. *In-Service Training of the Staff:* In-service training of physical education personnel is a tool for improving professional services with varying degrees of effectiveness. Some institutions have programs that really work; others ignore the matter entirely. More information is needed on what should be the extent of administrator responsibility for in-service training. Finally, information might well be obtained which would point the way a little more clearly toward the nature and scope of in-service training program.

30. *Delegating Responsibilities to the Staff:* Democratic procedure in departmental administration is viewed with some variations regarding the manner in which responsibilities may be delegated. Study is needed to throw more light upon democratic administrative procedure. Should staff committees be organized to handle fairly large units of responsibility such as the service curriculum? Is it desirable to delegate specific areas of responsibility to certain individuals who may be given considerable freedom in providing leadership in these areas? Should administrative responsibilities delegated to staff members be rotated regardless of top-flight ability to handle problems?

31. *Problems Related to Staff Load:* Problems of staff load have long caused concern to administrators. How may the various functions of the department be weighted so that, when responsibilities are assigned, all staff members will have approximately equal loads? What division can be worked out when departmental functions operate from 7 A.M. to 10 P.M.? In view of all of the duties which are expected of faculty personnel, what should be the requirement regarding office hours when staff members are available for consultation?

32. *Teaching Experience for Undergraduate Major Students:* One of the greatest problems facing those responsible for professional education in the field of physical education is the matter of undergraduate student teaching. In many situations field experiences are very unprofitable because of lack of good programs being offered in local schools. The "guest" status of the practice teacher pre-

vents him from really getting in and doing a job. He is strictly limited to the attitudes, policies, and procedures which are in operation by the permanent staff members. Many students learn more about how not to do it than they do about proper methods of teaching. How can problems be resolved? Should students be permitted to teach service classes in college under staff supervision?

33. *Special Fees to Staff for Extra Services:* Many staff members are frequently called upon to do extra duties. Sometimes these duties fall within the department—sometimes outside the department. What should be the policy regarding extra services? Should there be an extra fee or should some other adjustment be made in the load of the staff member in view of the additional assignments?

ADMINISTRATION: MANAGEMENT AND SUPERVISION

C. V. Langton
Oregon State College
Corvallis, Oregon

34. *Program Planning:* A study of methods whereby cooperative and continuous planning in programming and curriculum revision may be achieved by teachers, students, supervisors, and laymen is needed.

35. *Teaching Environment:* A study of the factors which contribute to the establishment and maintenance of a suitable environment for teaching is needed.

36. *Balance of Administrative and Supervisory Duties:* A study aimed at seeking a balance between supervisory and administrative duties of administrators should be made in order that those functions related to staff guidance and services to students do not suffer.

37. *Office Management of Physical Education:* Effective ways of handling office details in the areas of correspondence, filing system, office hours, taking care of visitors, a predetermined plan to take care of the many details involved in the management of physical education should be worked out.

38. *Integration of Teacher and Pupil Activity:* The integration of teacher and pupil activitiy with methods and objectives of the program should be studied.

39. *Re-Examination of the Principles of Physical Education:* A continuous re-examination of principles of physical education based on the philosophy of education should be initiated.

40. *Group Classification:* The determination of desirable standards to provide sound bases for the classification of students into homogeneous groupings should be undertaken.

ADMINISTRATION: FACILITIES, EQUIPMENT, AND SUPPLIES

B. E. Phillips
Veterans Administration
Washington, D. C.

41. *Development of Standards for the Evaluation of Physical Education Equipment:* Such standards should prove to be invaluable to administrators in the fields of physical education, athletics, sports, recreation, and health education in the selection of equipment so as to assure procurement of the best equipment at the lowest cost.

42. *Evaluation of Adaptations of Physical Education Facilities, Equipment, and Supplies in Meeting the Needs of Handicapped Individuals:* Knowledge of these adaptations should prove to be invaluable to members of the profession engaged in individaul, remedial, or corrective physical education or adapted sports as well as to participants who are handicapped.

43. *Survey of Safety Factors Involved in the Use of Protective Equipment in Contact Sports:* Knowledge of these factors should lead to continued improvement in effectiveness of the protective equipment from the standpoint of the user as well as of his opponent.

ADMINISTRATION: INSURANCE AND LEGAL

Arthur S. Daniels
Ohio State University
Columbus, Ohio

44. *Liability and Legal Status of Physical Education and Recreation:* There is need for greater understanding on the part of teachers and administrators regarding legal status of physical education in their own and other states, liability risks involved in teaching and administration, methods of legally protecting both students and physical education personnel.

45. *The Nature of Recent Trends in Liability Decisions:* A study and presentation of some recent decisions in the case of school accidents to show how the law works in liability cases is needed.

46. *Legal and Liability Pitfalls in the Administration of Interschool Athletics:* A study aimed at greater understanding about such "danger areas" as team transportation, medical supervision, reponsibility for athletic injuries, negligence, responsibility for injuries to spectators should be undertaken.

47. *Athletic Insurance:* There is need for a study of athletic insurance plans currently in operation and how they work; their advantages, disadvantages, and limitations.

48. *Professional Education and Preparation of Teachers and Coaches:* What should be included in the professional education of teachers and coaches regarding legal status of physical education and liability? How best may this area be covered? Should it get general treatment in all courses using the integration approach or should it receive systematic coverage in a single course?

LEADERSHIP

W. P. CUSHMAN
The Ohio State University
Columbus, Ohio

49. *Historical Influence of Leadership:* What changes have occurred in the types of leaders in college physical education in the United States in the past fifty years and to what influences are these changes due?

50. *Qualifications of Present Professional Leadership:* What is the current status of leadership in college physical education with regard to professional training, years of experience, origin of entry in the profession, faculty rank, degrees held, publications, and other distinctions?

51. *The Integration of Various Views Concerning College Physical Education:* It is apparent that there exists today within the college area, two or three diverging conceptions of the nature and function of college physical education. Within each of these spheres there are leaders who set the pace for others to follow. What are the essential characteristics of these diverging points of view? What are the essential characteristics and beliefs of the leaders who set these patterns? What is the nature of the group which follows these leaders?

52. *Qualifications Needed for Professional Leadership:* Certain qualities seem basic to good leadership in all fields of endeavor. What are these qualities as related to physical education and how can we recruit and select students to enter the field of physical education who possess these qualities?

53. *Personality Traits Necessary for Success in Physical Education:* From the student point of view, what personality traits are essential for successful teaching in physical education activity classes?

54. *Improvement of Undergraduate Professional Leadership:* Is it possible to improve leadership within the undergraduate professional student body in physical education? If so, what techniques may be employed by teacher-training institutions to insure this improvement?

55. *The External Responsibilities of Professional Leadership:* In what spheres of influence outside of the college physical edu-

cation field should leaders in college physical education participate? For example, in what movements, causes, national problems, and related organizations should our leadership make its influence felt?

HISTORY AND TRENDS

LLOYD M. JONES
Pennsylvania State College
State College, Pennsylvania

56. *History of College Physical Education Association:* A history of the College Physical Education Association; similar studies of other national, district, state, or local professional associations such as the AAHPER; state collegiate athletic associations, etc., should be undertaken.

57. *Institutional History of Required Physical Education:* A history of the required physical education at a college is needed. Studies of other phases of the program, including a history of each intercollegiate sport, the intramural program, the professional education program, health education, etc., are also desirable.

58. *Biographies of Outstanding Leaders:* A biography of William G. Anderson, his life and times, and biographies of each man and woman who have made notable contributions to the profession are needed. With each passing year invaluable material is being lost. In each state there are several persons whose record of work should be brought together in a biography before they pass away.

59. *History of School Health Education:* The origin and development of the school health education program, and a study of individuals and associations who have influenced the development of this phase of education should be undertaken.

60. *Trends in Personnel, Facilities, Program, and Administration in College Physical Education:* There is a need for an annual summary similar to the annual reports of such agencies as the National Safety Council, USPHS, National Recreation Association, and others which indicate the trends of the times. Such a summary would involve a report from colleges and universities each year including such items as number of staff employed, expenditures, new construction, number of students served, salary, content of program, attendance at contests, etc.

61. *Annual Publication of Completed Research:* Annual publication in the Proceedings or elsewhere of the titles of studies completed during the year dealing with research in physical education is desirable.

PROFESSIONAL EDUCATION

WILLIAM F. MEREDITH
University of Pennsylvania
Philadelphia, Pennsylvania

62. *National Standards for Teacher Preparation:* National standards are needed for the selection of candidates for professional preparation in the field of physical education.

63. *National Standards for Certification:* There is need for a study designed to achieve greater uniformity of standards for the certification of teachers of physical education.

64. *Standards for Institutional Accrediting:* National standards are needed for the accrediting of institutions engaged in the professional preparation of physical education personnel.

65. *Re-evaluation of Professional Curriculum:* A re-evaluation of the curriculum for the professional preparation of physical education personnnel on both the undergraduate level and the graduate level should be undertaken. Such studies would be designed to gear professional education more closely to the needs of teachers and coaches in the field.

66. *The Function of Guidance in the Professional Preparation of Physical Education Personnel:* What provisions should be made for the improvement of guidance in the professional preparation of teachers and coaches for optimum growth and effectiveness during college years?

PUBLIC RELATIONS

WILLIAM F. MEREDITH

67. *Purpose and Scope of Public Relations:* A statement of the purpose and scope of public relations as it applies to physical education, including athletics should be prepared.

68. *Techniques of Public Relations:* An evaluation of the techniques of public relations as they apply to physical education and athletics is desirable.

69. *Functions of Public Relations Officer:* There is need for a definition of the functions of the public relations officer in the area of physical education and athletics.

70. *Public Relations Functions in Physical Education Personnel:* A definition of the functions of the physical education personnel in the area of public relations is needed.

71. *Suggested Types of Public Relations Programs which will be Appropriate for Small Institutions:* Similar studies should be engaged in to determine the types of programs most appropriate for large institutions.

PROFESSIONAL STATUS

SEWARD C. STALEY
University of Illinois
Champaign, Illinois

72. *Salary Status:* What is the salary status of teachers of physical education in relation to experience, academic training, teachers of other subjects, and other professional workers?

73. *Work Load:* What is the work load of teachers of physical education in comparison with other teachers in regard to teaching load, contact hours, associated teaching activities, committee work, extracurricular activities?

74. *Social Status:* What is the social status of teachers of physical education in comparison with other teachers in school and community?

75. *Tenure:* What is the tenure of teachers of physical education? For those engaged in athletic coaching, what is the relationship between team success and tenure?

76. *Welfare:* What is the status of teachers of physical education in comparison with other professional workers with respect to unemployment compensation, illness, injury compensation, and old-age pensions?

LEARNING AND CONDITIONING

ARTHUR H STEINHAUS
George Williams College
Chicago, Illinois

77. *Effect of Certain Vitamins:* The effect of certain vitamins on performance and especially the role of Vitamin C in preventing soreness should be studied. There seems to be some evidence that administration of a large quantity of this vitamin prevents the soreness sometimes experienced by subjects in mental hospitals after they receive shock therapy, which causes violent contraction of muscles.

78. *Effect of Smoking on Athletic Performance:* There are available only two or three reasonably good studies on human beings which show that smoking cuts down performance in distance runs, but not in the short events, i.e., sprints. Data are needed for both running and swimming events.

79. *Effects of Psychological Inhibitions:* It would be interesting to study the effects of psychological inhibitions stemming out of childhood on athletic performance. This might be approached via the route of hypnotism or other forms of suggestion in both the phase of analysis to discover the causes of inhibition and in the therapeutic phases of the program. Naturally, someone well versed in psychiatry would need to direct such a study.

Effect of Water Ingestion on Capacity for Exercise

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University of North Carolina, Chapel Hill
(Submitted for publication, June, 1949)

THERE is a common impression that distention of the stomach with large amounts of water decreases the capacity for strenuous exertion. This study was designed to test the validity of this belief as it applies to (1) physiological response to a standard exercise (treadmill running), and (2) performance in competitive sports (swimming and track).

TREADMILL EXPERIMENTS

The experimental subjects were four healthy young men who were thoroughly trained in treadmill running. The standard exercise consisted in running on a motor-driven treadmill for five minutes at a speed of 7 M.P.H. and a grade of 17.5 percent in one series, and for three minutes at 12 M.P.H. and a 17.5 percent grade in a second series. The amount of water ingested was one liter in the earlier experiments and 1.5 liters in the later experiments. The water was drunk within a period of five minutes and exercise began three or four minutes later. Lung volume subdivisions were measured before and after water ingestion. Heart rate was recorded continuously during exercise with a cardiotachometer and respiratory minute volume was measured by collecting the expired air in a large gasometer. The following respiratory measurements were made before and after drinking water: vital capacity, complemental air, supplemental air, and chest expansion. In some of the earlier experiments maximal expiratory force (U-tube mercury manometer) was recorded. This was discontinued because several of the subjects were able to exert a force greater than 200 mm. Hg which was felt to be an unsafe elevation of intrathoracic pressure.

In each series of experiments, control observations without water alternated with experimental observations in which water was ingested.

Results.—The data are shown in Table I. Aside from a slight increase in complemental air and decrease in supplemental air (together indicative of elevation of the diaphragm) there were no significant alterations in respiratory measurements nor in maximal exercise heart rate and respiratory minute volume resulting from the drinking of water.

In all the experiments, water drinking produced sensations of distention and some disinclination for exercise, but there was no discomfort during the exercise.

TABLE I

INFLUENCE OF WATER INGESTION ON RESTING RESPIRATORY MEASUREMENTS AND ON CARDIORESPIRATORY RESPONSE TO TREADMILL RUNNING

Exercise	Water ingested (liters)	Number of tests	Vital capacity (liters)		Complemental air (liters)		Supplemental air (liters)		Chest expansion (inches)		Maximal exercise heart rate (beats per min.)	Minute volume ventilation (liters)
			Before water	After water	Before water	After water	Before water	After water	Before water	After water		
5', 7 mph, 17.5%	Control	10	—	—	—	—	—	—	—	—	185	54
5', 7 mph, 17.5%	1.0	7	4.9	4.9	3.0	3.1	1.9	1.9	2.8	2.7	183	55
3', 12 mph, 17.5%	Control	5	—	—	—	—	—	—	—	—	204	76
3', 12 mph, 17.5%	1.0	5	5.5	5.5	3.2	3.5	2.2	1.9	3.5	3.2	204	74
5', 12 mph, 17.5%	Control	15	—	—	—	—	—	—	—	—	176	63
5', 12 mph, 17.5%	1.5	16	4.9	4.8	3.1	3.1	1.8	1.6	2.0	1.9	177	63

TABLE II

INFLUENCE OF WATER INGESTION ON PERFORMANCE IN COMPETITIVE SPORTS

Event	Number of subjects	Number of tests	Average Time		Difference of the means	Standard error of the difference of the means	Critical ratio
			Control	After water			
50-yd. swim	11	48	26.9 sec.	27.0 sec.	0.1 sec.	0.281	0.35
200-yd. swim	20	62	146.5 sec.	147.9 sec.	1.4 sec.	0.273	0.51
220-yd. run	2 (Trained)	22	27.27 sec.	27.14 sec.	0.13 sec.	0.218	0.60
220-yd. run	9 (Untrained)	35	29.05 sec.	29.06 sec.	0.01 sec.	0.372	0.03

PERFORMANCE IN COMPETITIVE SPORTS

Swimming and track events were selected for study because the times in these events provided quantitative criteria of performance. The 50- and 200-yard swims and the 220-yard dash were studied on varsity athletes and an additional study of the 220-yard dash was made on a group of untrained students in a physical education track class. In each series, the event was performed five minutes after drinking one liter of water, with alternate control and experimental observations.

Results.—The results are summarized in Table II. In no case was performance adversely affected by the prior drinking of a large volume of water. A few observations on the mile run gave the same result, but the data are not included because they are insufficient for statistical evaluation.

DISCUSSION

It has been assumed that the ingestion of large amounts of water unfavorably influences the capacity for work in one or more of the following ways: (1) interference with movement of the diaphragm as a result of increased intra-abdominal pressure, (2) decreased inclination for exertion due to the subjective impression of distention, and (3) heat cramp due to failure to replace salt when a large volume of water is ingested after copious sweating. The present study is concerned with the first two factors only, since the exercise period was not preceded by a period of sweating.

It is obvious that the ingestion of large amounts of water must result in some increase in intra-abdominal pressure. Ingested water passes fairly rapidly from the stomach into the small intestine where it is absorbed. The rate at which water leaves the stomach is increased by strenuous exertion. Thus, 15 minutes after the administration of 500 ml. of water, the average residue was 223 ml. in resting subjects and 199 ml. in exercising subjects (1). The water which enters the small intestine is gradually absorbed with a resultant decrease in intra-abdominal pressure.

The contents of the abdominal cavity may be regarded as a fluid mass. Hence, the rise in intra-abdominal pressure resulting from the ingestion of water is proportional to the residual volume of water present in both the stomach and the intestine. In the present experiments not more than 15 minutes elapsed from the beginning of water ingestion until the end of the exercise. It is probable that at this time about one-half the ingested water was still in the stomach and about one-fourth was in the small intestine, as yet unabsorbed. This consideration is advanced against the possible contention that the lack of effect on performance was due to rapid absorption of the water and return of the intra-abdominal pressure to normal.

The slight increase in complemental and decrease in supplemental air volumes following the ingestion of water are indicative of elevation of the diaphragm. The absence of a significant decrease in vital capacity is probably due to the fact that any increase in the volume of air moved in breathing is the result chiefly of greater costal enlargement, increased excursion of the diaphragm being of minor importance (2).

In the swimming and running tests, the initial psychological bias of the subjects was invariably a belief that performance would be adversely affected by the drinking of such a large amount of water, and the absence of any such effect came as a distinct surprise to them. In no case was there any nausea resulting from exercise after drinking water. It is well known that drinking water prior to or during a contest may cause nausea in some athletes and in these cases the practical experience of the coaches, trainers, and the athletes themselves should, of course, prevail. Nor is the drinking of such large amounts of water recommended as a routine procedure. These large water volumes were used deliberately in an attempt to demonstrate adverse physiological effects if they exist. The results of these studies are of value primarily in indicating the probability that no harmful effects would result from permitting athletes to maintain adequate water balance by drinking water during athletic contests. Unpublished data from this laboratory indicate that a football game, even when played in moderately cool weather, may result in sufficient dehydration to affect performance adversely when water drinking is too severely restricted. Studies on the effects of dehydration and of voluntary and forced rehydration on athletic performance will be reported in a later communication.

SUMMARY

The ingestion of 1.0 to 1.5 liters of water five minutes before exercise had no adverse effect on heart rate and minute volume of ventilation during treadmill running nor on performance time in swimming and track events. It is suggested that, except in the case of the occasional athlete who suffers nausea, there is no physiological justification for the rigid restriction of water intake in athletic contests.

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The Development of a Test of Badminton Playing Ability

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(Submitted for publication, November, 1948)

FOR many years an objective measure of badminton playing ability has been needed at the University of Nebraska for classification and grading purposes. Work on a test to meet this need has been in progress for a period of over four years. After preliminary investigation and experimentation the badminton volleying test described in this study was devised. The test obviates some of the inadequacies inherent in other measuring instruments of badminton playing ability since it requires no special equipment, involves only one player, the testing time is brief, and many subjects may be tested simultaneously.

Directions for administering this test, statistical data giving evidence of its reliability and validity, and norms are here presented. Data were obtained from records of 529 badminton players; the subjects were medically approved sophomore women in regular classes at the University of Nebraska.

TEST DIRECTIONS

1. *Equipment:*
   a. Badminton racket in good condition.
   b. New indoor shuttlecock.
   c. Unobstructed wall space at least ten feet in height and ten feet in length.
   d. Stop watch.
   e. Score sheets.
   f. Pencil.
2. *Markings:*
   a. A one-inch net line marked on the wall five feet above and parallel to the floor.
   b. A starting line drawn on the floor six feet six inches from the base of the wall.
   c. A restraining line marked on the floor three feet from the base of the wall and parallel to the starting line.

The writers wish to express appreciation to Miss Jane A. Mott who acted as the third judge and assisted with this study.

3. *Assistants:*

a. Timer (gives the signal, "Ready-Go" and "Stop").

b. Scorer (counts the number of legal hits).

c. Recorder (makes a record of the number of legal hits that are made).

4. *Description of Test.*—The player taking the test stands behind the starting line holding the badminton racket in one hand and the shuttlecock in the other. On the signal "Ready-Go," the shuttlecock is served in a legal manner against the wall on or above the net line. The shuttlecock is played as many times as possible against the wall in 30 seconds. Three trials are given each player. Rest is allowed between trials. Before the first trial a practice period of 15 seconds is given.

Only shuttlecocks hitting on or above the net line are considered good; one point is counted for each such good hit. After the shuttlecock has been served the player may move up to the restraining line if she wishes. It the restraining line is crossed, the hit is not counted but the shuttlecock is still in play. If the bird is missed or gets out of control, the player must retrieve it and continue by putting the shuttlecock back in play with a serve from behind the starting line.

5. *Scoring.*—The score is the sum of the number of legal hits made on or above the backboard net line in the three trials.

6. *Comments.*—Occasionally fouls such as "carrying" and double hitting occur during the test. These fouls are disregarded and the person being tested continues. The time consumed in committing the foul, and the fact that many such fouls result in the shuttlecock falling to the floor, provide sufficient handicaps in themselves. The time element of the test thus provides an automatic penalty.

It cannot be overemphasized that unreliable and invalid results may be obtained on this test if students are not well acquainted with volleying practice of this sort and if insufficient practice time is allowed. Volleying is a good motivating and practice device and should be used throughout the season. This type of practice results in speedier action, in improved control, and focuses attention on the necessity of watching the shuttlecock.

The details of the test should be demonstrated fully so that the procedure and method of scoring are clear.

EVIDENCE OF RELIABILITY

1. Evidence of the reliability of the judges was shown as follows. The ability to win games was taken as the criterion of playing ability. Three experienced judges graded the badminton playing ability of 27 girls on a 1-10 point scale. The judges' ratings for each girl were totaled. The summed judges' ratings were then correlated with the percentage win of these 27 players in a round-robin tournament

involving 351 games. The ability of the judges to pick winners is indicated in a correlation coefficient of .90, standard error .03.

2. The Badminton Volleying Test was administered twice to fifty players. The test was given on different occasions within an interim of three days. The total scores made on the two administrations of the test were correlated. The resulting indication of reliability is a coefficient of .90 with a standard error of .02.

EVIDENCE OF THE VALIDITY OF THE TEST

1. Three experienced judges graded the badminton playing ability of 68 girls on a 1-10 point scale. The total of the judges' opinion was correlated with the total score that these players made

TABLE I

T-SCALES FOR BADMINTON VOLLEYING TEST

Raw Score	*T Score*	*Raw Score*	*T Score*	*Raw Score*	*T Score*
148	78	108		68	46.5
147		107	62	67	46
146		106		66	
145		105	61.5	65	45.5
144		104	61	64	45
143	74	103	60.5	63	44.5
142		102		62	44
141		101	60	61	43
140		100	59.5	60	42.5
139		99		59	42.5
138	72	98		58	42
137		97	59	57	42
136	71	96	58.5	56	41.5
135		95	58	55	41.5
134		94	57.5	54	41
133		93		53	40.5
132		92	57	52	40
131		91	57	51	39.5
130		90	56.5	50	38.5
129		89	56	49	38
128	69.5	88	55.5	48	37.5
127	68.5	87	55	47	37
126		86	54	46	36.5
125		85	53.5	45	35.5
124		84	53	44	34.5
123	67.5	83	53	43	34
122	67	82	52.5	42	33
121		81	52	41	
120	66.5	80	51.5	40	
119		79	51.5	39	31.5
118		78	51	38	30.5
117		77	51	37	29
116		76	51	36	
115	66.0	75	50.5	35	
114	65	74		34	
113	64.5	73	50	33	
112	64	72	48.5	32	25.5
111	63	71	48	31	
110	63	70	47.5	30	
109	62.5	69	47	29	21.0

on the Badminton Volleying Test. The validity of the test determined by this means is .71; standard error, .06.

2. A badminton round-robin tournament was conducted with 27 girls as players. Each girl played every girl in the tournament (a total of 351 games). When the percentage of the total games won by each contestant was correlated with the total score made on the Badminton Volleying Test, a coefficient of .60 and a standard error of .12 were found. In a similar tournament involving only seven players and 21 games, a correlation with the total test score was .72, for the standard error, .18.

3. The percentage of the total games won by each of the round-robin tournament players was correlated with the total of the judges' opinions. A resulting correlation coefficient of .90 with a standard error of .03 was found.

THE DEVELOPMENT OF NORMS

Table I gives T-scale values for the raw scores, on a total of three trials. This T-scale is based on scores made by 178 subjects at the University of Nebraska. The backboard surface was wood. Since the nature of backboard surfaces differs, test scores may vary somewhat. T-scores should be constructed preferably for each testing situation. These scores, however, are indicative of the results to be expected.

SUGGESTIONS AND CONCLUSIONS

1. A simple test of badminton playing ability has been described. The reliability of the test is .90; evidence of validity varies from .60 to .72. The test is simple to administer, objective, involves little time, and is useful as a practice device.

2. Statistical evidence indicates that the Badminton Volleying Test serves well as a general means of classification. The test is not adequate in itself, however, to be used as the sole means of measuring individual attainment for grading or diagnostic purposes.

3. The addition of other elements to the test might result in a measuring instrument sufficiently valid on which to base individual measurement.

4. Further experimentation involving lengthening the distances of the restraining and starting lines from the base of the backboard might result in better playing form and increased test validity.

A Study of Existing State High School and Other Selected Athletic Benefit Plans*

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(Submitted for publication, March, 1949)

INSURANCE coverage has been rapidly extended in recent times in almost all fields in keeping with increasingly wide acceptance of the view that the calculated risks of injury and loss resulting from all types of human conduct should be distributed as broadly as possible so as to cushion the immediate financial shock upon the victim.

There is an ever-present danger of injury in all sports, and the loss must fall on someone. The exact extent of hazard and risk in scholastic athletics apparently had not been determined to any great extent before the Wisconsin Interscholastic Athletic Association in 1930 established the first thoroughly organized program of high school athletic insurance and started a trend which now has been joined by 31 other state athletic associations. The analysis of risk ratios largely has been on an empirical basis, resulting from the establishment of insurance rather than establishing the basis for the programs of insurance themselves.

At present sixteen states do not possess a plan for insuring high school athletes. The experience of the 32 states with such plans made it seem desirable to attempt to pull together the far-flung data on the subject, analyze and correlate it insofar as possible, and perhaps identify trends which would be a material aid to further extension of such insurance as well as a means for improvement and strengthening of present plans in operation.

Consequently, it appeared that any such study should logically be concerned with (1) what types of plans are now in existence; (2) whether there is a basis for a comparison of the costs of premiums under the various plans; (3) what kinds of coverages there are; (4) how benefit plans are financed; (5) whether the benefits derived from various types of plans are comparable; (6) what number of students are covered by athletic benefit plans; (7) what the most common injuries are and how to classify and compare them if possible; (8) whether an analysis of the claims filed and the benefits paid would reveal the protection to be adequate under

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the various programs, and (9) what the trends are in the development of the protective plans.

To bring such a study within range, it was necessary to limit it to the interscholastic aspects. Other limitations which necessarily developed were as follows: (1) data respecting the state athletic associations would include only information from those state associations now using some type of athletic injury protection; (2) the study would involve only known commercial companies which write athletic insurance policies, such companies to be determined after as extensive a survey as would be feasible, and (3) some aspects of the study would be limited to the states furnishing pertinent information.

SOURCE OF DATA

The records of state high school athletic associations proved to be a fertile source of information as to plans now in existence, and any contemplated programs. The executive secretary of the National Federation of State High School Athletic Associations was found to maintain an up-to-date clearing house of information on the subject. Mail inquiries were productive of the needed data in most instances, supplemented by personal interviews when additional information was required. Commercial companies turned out to be an important source of information when heightened significance developed in a comparison of commercial with non-commercial programs. In the majority of instances they cooperated willingly in supplying data from their files or by indicating their reasons for not being interested in such underwriting. Approximately fifty companies were contacted with forty responding.

The executive officers of the respective state high school athletic associations furnished most of the information respecting athletic injury benefit plans. Their names and addresses were furnished by the executive secretary of the National Federation of State High School Athletic Associations, and of the 32 inquiries sent by mail, 31 responded with data which included yearbooks, handbooks, pamphlets, bulletins, and published and unpublished statements. Personal interviews were conducted with persons interested in the movement, and correspondence was exchanged with others at far-distant points.

The data gathered reflected the essential characteristics of the plans, including costs, patterns of coverage, schedules of benefits and the extent of coverage of the various plans in existence, plus information on the relative frequency of athletic injuries and their severity. However, research into the nature of injuries and the sports in which they occur, i.e., actuarial data, proved to be scattered and difficult to assemble. The Federation does not compile such statistics. Among the states common denominators were lacking because some states

collect elaborate information of the sort while others do not as yet maintain research departments at all. It was possible to gather information regarding benefits paid for various types of injuries from ten states for a total of 24 years.

Virtually all investigators who have made contributions to this field have paid tribute to the leadership of Wisconsin and the activity of P. F. Neverman in the developement of the first effective plan. C. E. Forsythe first reported on it in an article entitled "Athletic Accident Benefit Plan," in the *Journal of Health and Physical Education,* February, 1941.

The development of the plans being largely a local phenomenon, the reporting naturally has been mainly from the vantage point of the individual states with very little material on the national trends. The National Federation of State High School Athletic Associations has offered no athletic benefit plan of its own.

Neverman himself contributed valuable information on the Wisconsin experience under his guidance when in November, 1945, the *Journal of Health and Physical Education* carried his article, "The Wisconsin Benefit Plan." He told of the two years' of preliminary study of athletic injuries, followed by a fruitless effort to interest insurance companies in such coverage. Establishment of the Wisconsin plan then followed.

RESULTS AND FINDINGS

Two general types of plans now exist: the state association organized and operated programs and the commercially underwritten policies. Of the thirty-two plans in operation on a statewide basis, twenty-eight may be described as state association plans. That is, they are either directly operated by the state athletic associations or function as an insurance concern specifically organized for that purpose by the association as a wholly owned and operated subsidiary. The remaining four are organized with commercial companies as the underwriters, whether on a blanket contract with the state association or with insurance written directly with the individual schools under state association endorsement and encouragement.

The state plans may be classified as (a) those modeled after the pioneering Wisconsin plan, providing coverage for each student upon the payment of a single registration fee; (b) the New York plan and its followers, providing coverage on a "per sport basis," necessitating registration of students for each sport season; (c) the Iowa plan and other adherents which follow the Wisconsin plan as to general form, but which have created regular insurance companies as subsidiaries, and (d) the New England variation of the Wisconsin plan, differing from its prototype in that more than one state, in this instance the six members of the Council of the New England Secondary School Principals Association, joined in a benefit plan.

TABLE I

VARIOUS FEATURES OF ATHLETIC BENEFIT PLANS

State	Date of adoption	Who contributes to premium payments and operation of plans: Parent	School	State Assn.	Kind of company: State Assn.	Commercial	All sports	All sports except football	Football	Other sports	Special benefits: Principal sum	Hospital	Travel	X-ray
Ark.	1947–48		×			×	×	×			×	×	×	×
Calif.	1939–48	×	×		×		×	×	×			×		×
Conn.	1937–48	×	×		×		×	×		×		×	×	×
Fla.	1941–48	×		×	×				×		×	×		×
Ga.	1936–48	×	×		×		×	×	×			×		×
Idaho	1939–48	×	×	×	×		×	×	×		×	×	×	×
Ind.	1947–48	×			×	×	×	×				×		×
Iowa	1939–48	×		×	×		×	×	×			×		×
Kans.	1938–48	×		×	×			×	×	×		×		×
Ky.	1939–48	×	×		×		×	×				×**		×
Maine	1937–48	×	×		×		×	×				×**		×
Mass.	1937–48	×	×		×		×	×			×	×**	×	×
Mich.	1940–48	×	×		×		×	×			×	×**		×
Minn.	1937–48	×	×		×		×	×			×			×
Miss.	1944–48	×	×		×		×	×						×
Mont.	1938–48	×	×		×		×	×			×	×*		×
Nebr.	1939–48	×	×		×		×	×				×*		×
N. H.	1937–48	×	×		×		×	×	×	×	×	×	×	×
N. J.	1948–	×				×	×	×	×	×				×
N. Y.	1933–48	×	×		×		×	×	×	×	×	×	×	×
N. D.	1934–48	×		×	×		×	×	×	×		×		×
Ohio	1947–48	×	×		×		×	×	×	×	×	×***		×
Okla.	1942–48	×	×		×		×		×			×		×
Ore.	1946–48	×	×		×		×	×	×	×	×	×**	×a	×
Pa.	1945–48	×	×		×		×		×	×		×**		×
R. I.	1937–48	×	×		×		×	×						×
S. D.	1939–48	×	×		×		×	×				×		×
Utah	1941–48	×	×		×		×	×				×**		×
Vt.	1937–48	×	×	×	×		×	×				×		×
W.Va.	1947–48	×	×	×	×		×	×	×	×	×	×	×	×
Wis.	1930–48	×	×		×		×	×	×			×		×

* Plus 35¢.

** Plus 25¢.

*** Plus 25¢ to 75¢.

a Plus $1.50 for 3 months.

Table I shows on a state-by-state basis who contributes to the premium payments and operation of the plans, the kind of company, the sports covered, and the special benefits incorporated into various plans over and above the common indemnities for the types of injuries customarily covered.

Premiums.—While there is no stereotyped pattern for the premiums charged in the various states either under state plans or commercially underwritten policies, there is a basis for comparison when the costs of coverage and the benefits provided are correlated, as in Table II. Mississippi, for example, charges a low premium of $1.50 per year per pupil for all sports, including football, but does not extend any special benefits covering principal sum for death, hospitalization, transportation, and x-ray. Wisconsin, on the other hand, charges $2.00 for all sports, including football, and extends the special benefits. The comparison of the costs of commercial plans with state plans is significant; the New Jersey commercially written plan includes premiums up to $7.50 and is much higher than state plans. The Commercial Casualty Company of Chicago writes the Indiana insurance at premiums of $2.75 for all sports, comparing favorably with and actually being lower than plans in California, Ohio, and New York.

Coverage.—Practically all states cover their athletes in all sports, including football, as shown in Table I, and also offer plans exclusive of football. Arkansas offers an innovation in coverage based on all sports for the entire year with premiums on a squad basis without individual competitors being insured by name.

Benefits.—The benefits derived from the various plans are patterned after the schedules established for state workmen's compensation, insofar as specific benefits are concerned. However, there is a wide variation in the number of special benefits offered over and above the standard injuries. As Table I shows, all the states offer x-ray except Mississippi; hospitalization is offered by all except Kentucky, Mississippi, Montana, New York, and South Dakota; transportation is covered by only ten states, and the principal sum by thirteen. All states offer different indemnities for individual injuries, i.e., the loss of sight of one eye ranges from $75 in New York and New Jersey to $250 in Indiana and Iowa and has an average of $200. A fractured radius calls for $25 in Pennsylvania and $50 in New York and New Jersey, the average being $32.50. Dislocation of the knee varies from $10 in Pennsylvania to $62.50 in Arkansas with an average of $20. In the case of a broken tooth, benefits range from $10 to $25 and the average is $12. Hospitalization, a special benefit, ranges from $22.50 in Pennsylvania to $250 in New Jersey, the average being $50. The range, middle fifty percent, and the median in benefits are shown in Figure 1.

TABLE II

COST OF PREMIUMS

State	All sports	All sports except football	Football	Other sports each
Arkansas	$157.00*	$32.00**	....	....
California	4.00	2.00	$3.50	....
Connecticut	2.00	1.00	....	....
Florida	....	....	2.00	$1.00
Georgia	2.50	1.00	1.75	....
Idaho	1.00	.50B†	....	....
Indiana	2.75	1.25	....	....
Iowa	2.00	1.00	....	....
Kansas	....	1.00	1.50	....
Kentucky	....	....	1.50	.50
Maine	2.00	1.00	....	....
Massachusetts	2.00	1.00	....	....
Michigan	1.75	1.00	....	....
Minnesota	2.00	1.00	....	....
Mississippi	1.50	1.00	....	....
Montana	1.00	.50S††	....	....
Nebraska	2.00	1.00	....	....
New Hampshire	2.00	1.00	....	....
New Jersey	7.50	5.00	5.00	3.00***
New York	2.75	1.50	2.50W†††	$2, $1, 50¢
North Dakota	2.00	....	1.00	50¢, 25¢
Ohio	3.50	1.25	2.25	....
Oklahoma	1.50	.50	.50	....
Oregon	....	....	3.50	$1.50, $1
Pennsylvania	....	....	1.00	$1,50¢,35¢,25¢
Rhode Island	2.00	1.00	....	....
South Dakota	1.00	.50	....	....
Utah	1.50	.75	....	....
Vermont	2.00	1.00	....	....
West Virginia	....	....	2.00	1.00
Wisconsin	2.00	1.00	....	....
High	7.50	5.00	5.00	3.00
Low	1.00	.50	.50	.25
Average	2.26	1.16	2.15	....

* For squad of 31-40.
** For squad of 31-40.
*** All sports excluding football and basketball.
† B—Boxing.
†† S—Skiing.
††† W—Wrestling.

Contributions.—The benefit plans are financed by premium payments made by the parents in all states except Arkansas, where payment is by the school. The schools make their contributions through the enrollment fees paid to the state associations based on the size of the school enrollments, the fees ranging from $5 to $20. In addition, eight state associations make direct contributions in support of their plans. The sources for contributions are shown in Table I.

Extent of participation.—Wisconsin, New York, Minnesota, and North Dakota have compiled statistics which indicate that the num-

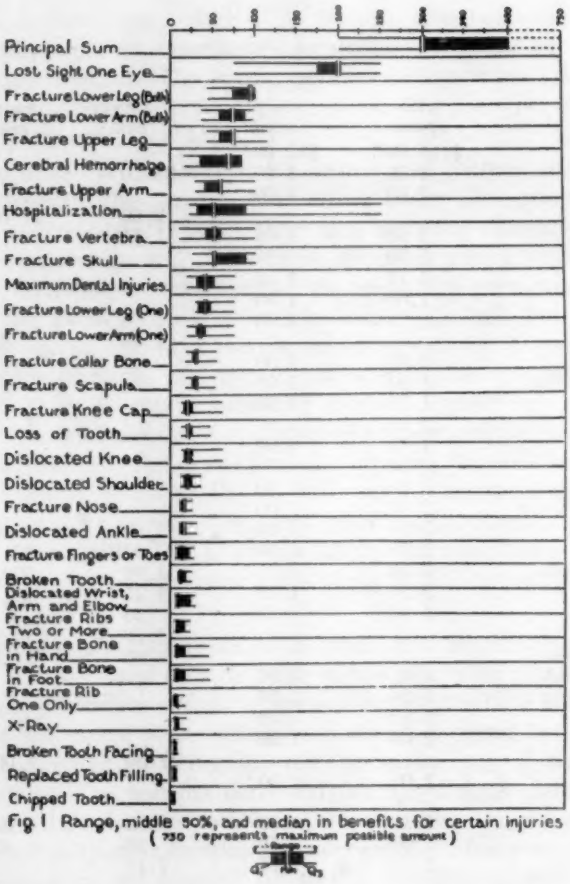

Fig. 1 Range, middle 50%, and median in benefits for certain injuries (750 represents maximum possible amount)

ber of students covered by athletic benefit plans has been steadily increasing in the last six years. It may be said that coverage is comprehensive in those states.

Injuries.—The most vulnerable area according to the writer's findings is the mouth region with the teeth incidence occurring 5,423 times, or 29.8 percent of 18,193 injuries, in a period of twenty-four years. A decided contrast is noted because the femur, the largest bone in the body, was the least vulnerable area with 84 accidents, or .5 percent of the total number of injuries. The knee, ankle, foot, and toe areas rank seventh, eighth, and ninth with percentages of 5.0, 4.9, and 3.8 respectively. Injuries to the skull and head rank fourteenth in frequency or 1.9 percent for the combined study. These data, largely a by-product of statistical analyses made in connection with the operation of some of the plans, open a path to safety action re-

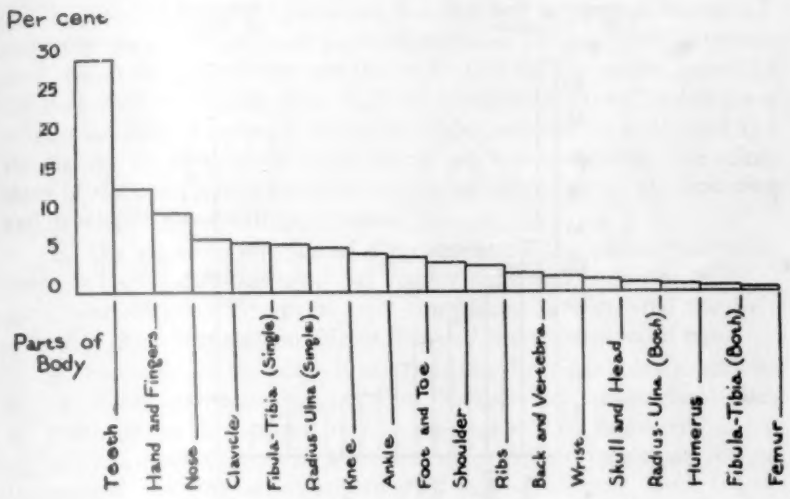

Fig. 2 Per cent of injuries for twenty-four years.

ducing injuries. Figure 2 graphically displays the related percentages of injuries.

Protection.—An analysis of the claims and benefits reveals extensive protection, but the indemnities vary widely in the extent to which they cover the actual expenses incurred. The teeth rank first in number of occurrences and also claim the largest total payments: 20 percent of the total expenditures for twenty-four years. The fibula-tibia (single) accounts for a fifth-ranking total of injuries and a second-ranking total of payments, 11 percent; the clavicle and radius-ulna (single) rank third and fourth in percentage of total claims, 9.7 and 8.7 percent respectively. Hand and finger injuries are fifth in total payments, or 7.1 percent, and nose injuries are sixth in payments with 6.6 percent of the total claims. The ranking of the claims as to injuries causing them is displayed in Figure 3, both as to the amounts paid out for specific injuries and the percentages. A few of the injuries not covered in the plans are hernia, cuts, bruises, contusions, sprains, torn ligaments or muscles, or infection of any origin.

CONCLUSIONS

1. Prior to the establishment of a benefit plan, the parents shoulder the burden of paying for the treatment of any athletic injuries sustained by their children, or the school, cognizant of the moral obligations usually acknowledged by the administrators and teachers, meets the expense as it arises.

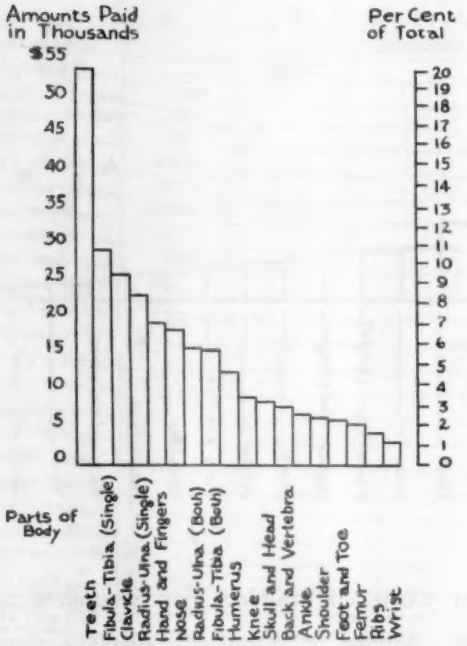

Fig. 3 Amounts and per cent of amounts paid out for specific injuries for twenty-four years.

2. It is a possible trend that all states may adopt athletic injury benefit plans within the near future as a more equitable means for compensating the victims of accidents in sports.

3. The athletic accident benefit plan now has a background of established success in a number of states, and the experience of the 32 states indicates that it is better for schools to sponsor athletic benefit plans than to try to meet the costs themselves or ask the parents to do so because (a) it is more equitable for schools to meet the expense, (b) the operation of such a plan offers an unusual opportunity for the study of athletic injuries with a view to the reduction in their number, and (c) when players and the school realize that after a premium is paid they can have medical attention as a matter of course, prompt treatment is obtained and injuries do not develop complications.

4. The original and perhaps basic purpose of instituting benefit plans was to give financial aid. Plans still may be fully justified solely on that account. However, this objective has in some instances actually become secondary to the advantages offered by the unusual opportunity for the study of athletic injuries and their reduction in number and severity.

5. State association plans are much more numerous than commercially underwritten plans probably because (a) commercial premiums, with a few exceptions, are too high; (b) the companies generally are backward in pushing into the field, sometimes almost to the point of unreasonably refusing to investigate the possibilities in it; and (c) the leaders of many state associations, after encountering the reluctance of the commercial underwriters, have forged ahead on their own and developed successful programs.

6. The negative attitude of the commercial companies may arise from (a) over-cautiousness, (b) higher overhead expense, and (c) scant competition. However, four companies have entered the field and offer programs comparable to those of the state associations.

7. Coverage of the plans is not complete for all scholastic athletes even in states with plans in operation, because (a) some schools may not participate in the plans; (b) if the payment of premiums is left up to them, parents may in some instances fail to participate owing to financial inability or disapproval of such insurance, and (c) in some of the state plans the absence of the special benefits of principal sum, transportation, hospitalization, and x-ray results in voids in coverage, and in others the fact that these benefits are not included with the over-all premium may result in the plan being ignored.

RECOMMENDATIONS

1. All scholastic athletes should be covered, either under one of the commercial plans or under a plan organized and operated directly or indirectly by a state athletic association.

2. The coverage should be compulsory.

3. The benefits should be as broad as possible, including in all instances the so-called special benefits of principal sum, transportation, hospitalization, and x-ray.

4. The experience of the state associations pledging financial support to the plans from their general funds indicates that this is a worthy activity without great risk of heavy financial loss. It seems reasonable that a levy of approximately five percent on the proceeds of state athletic events should be devoted to such purposes as defraying administrative expenses, building up a reserve fund for unforeseen contingencies, or even going into the payment of some benefits, if necessary.

5. If local circumstances make such a diversion of funds wholly impracticable, the facilities of several reputable commercial companies are now available and should be investigated.

6. Data compiled in recent years by the office of the National Federation of State High School Athletic Associations on the nature and extent of scholastic injuries could be supplemented as a valuable by-product of the operation of present plans. Steps should be taken

to establish a research department, probably in the Federation offices, to tabulate such information on a comprehensive and uniform basis from all the state commissioners.

7. All information collected on the incidence and severity of injuries should be compared and analyzed, with tabulations sent back to the state associations annually, so that the associations may in turn make their own distributions to their members.

8. The distinct advantage to the state associations in the operation of their own plans of fostering the safety aspect of sports and thereby curtailing the payment of benefits and increasing the safety of participation should be fully recognized.

9. There should be continuing investigation and research into types of new and safer athletic equipment of all kinds, such as the development of more protective football helmets which pay large dividends in lessened injuries.

10. If a commercial company does the underwriting, there should be close cooperation between the company and the sponsoring or endorsing state association.

11. The program should have uniform application to the member schools of the association, so that the coverage may be as complete as possible.

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A Survey of Teachers' Needs in Health Education, Physical Education, and Recreation

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(Submitted for publication, March, 1949)

THE PROBLEM

THE problem posed for this study was that of determining the needs of teachers in the specialized fields of health education, physical education, and recreation as a basis for evolving a functional graduate program for teachers in service in these specific areas.

A graduate study program was inaugurated at the State Teachers College, Cortland, New York, during the latter part of the 1947-48 college year in which opportunity for specialization was to be provided for students entering the program in the areas of health education, physical education, and recreation education. It was believed that a more practical and functional program might be formulated if a survey were conducted for ascertaining teachers' needs in these major fields.

The Graduate Committee* at the above named college then proposed the conduct of a survey by soliciting ideas and opinions from individuals representing five general classifications of teachers and administrators for whom the problem appeared to be one of immediate concern.

A survey questionnaire was developed by the Graduate Committee through conferences with, and recommendations by, the college faculty. The questionnaire was delivered to 350 professional workers, including teachers in service, college seniors who had completed ten weeks of practice teaching in communities at some distance from the college campus, and elementary and secondary school principals. Members of the college faculty, district and city school superintendents in New York State, and college and public administrators in health education, physical education, and recreation were also asked to submit their opinions. In some instances conferences were arranged with groups of teachers and administra-

* Members of the Graduate Committee responsible for conduct of the survey were Dr. Ross Allen, Dr. Ross Bowers, Dr. Harlan Metcalf, Dr. Donovan Moffett, Dr. Maxwell Park, Dr. Ben A. Sueltz, chairman.

tors for discussion of the various phases of the problem, but in the majority of cases the survey questionnaire was dispatched and returned by mail.

Returns were received from professional workers in the field as noted below:

State Teachers College seniors	117
State Teachers College faculty members	27
Health and physical education teachers in service	78
Public school principals and superintendents	61
College and public service administrators in health education, physical education, and recreation	14
Total	297

TABULATION OF THE DATA

Pertinent excerpts from the survey questionnaire as developed for the purpose of ascertaining teachers' needs follow with composite tabulations of the data accumulated from the 297 respondents.

I. General Problems:

1. How long a summer session do you favor?
   - 6 wk. 53%
   - 8 wk. 30%
   - 10 wk. 1%
2. What organization for instruction do you favor?
   - Workshop 45%
   - Seminar 38%
   - Class 19%
3. Do you favor field courses involving travel?
   - Yes 74%
   - No 12%
4. Do you favor observation in the demonstration school?
   - Yes 68%
   - No 18%
5. What portion of the curriculum would you prefer to be elective?
   a. In cultural areas?
      - None 6%
      - One-half 38%
      - Nearly all 40%
   b. In major professional field?
      - None 9%
      - One-half 55%
      - Nearly all 15%

Will you state here or on another sheet ideas you have about content and conduct of graduate study?*

Need work in curriculum construction for sound all-round physical education programs (45).

Need work for providing for individual differences in children (38).

Make courses practical and real (32).

Utilize small discussion groups and seminars (13).

Provide outstanding instructors (10).

Keep standard of work at a high level (7).

Provide opportunity for work on individual problems (6).

II. Problems Involved in Teaching:

List *specific teaching* problems which are *frequently met* and for *which graduate study should provide help;* e.g., diagnostic and remedial procedures, providing for pupil differences, using community resources, understanding current world affairs, etc.

1. The problem of understanding children, including guidance, discipline, delinquency, etc. (61).
2. How to improve school and community relationships (49).
3. How to organize and supervise programs and utilize facilities (42).
4. Need for broader cultural understandings (42).
5. How to use and interpret tests and other appraisal techniques (42).
6. Utilization of community resources (32).
7. How to use audio-visual teaching aids and supplementary materials (25).
8. Need for developing better inter-faculty relationships and professional ethical standards (24).
9. Health problems in the school and community (19).
10. Insurance, liability, etc., covering accidents, state laws (5).

III. Areas of Study on Graduate Level:

Below are listed brief titles which indicate an area or type of study. Add others you regard important. Mark with letter X those you regard as valuable, with XX those most valuable. Do not mark those of little value (See Table I).

SUMMARY

General Professional Education

In the general professional educational field it may be noted that first place in importance is given to "guidance and evaluation" with the five classifications of respondents equally weighted. Al-

* Ideas expressed by respondents are listed with their frequency of occurrence indicated in parenthesis.

TABLE I

IMPORTANCE RATINGS GIVEN TO AREAS OF STUDY BY RESPONDENTS OF FIVE DIFFERENT CLASSIFICATIONS

	"A" Cadet Teachers		"B" Faculty Members		"C" Teachers in the field		"D" Principal and Supt.		"E" Administrators in H.Ed., P.E., and Recreation		"F" Totals		"G" Equally weighted 5-classification percentage "importance rating"
Number of respondents in classification	(117)		(27)		(78)		(61)		(14)		(297)		
Total possible score	(234)		(54)		(156)		(122)		(28)		(594)		
A. *Professional Fields:*	*Score*	*%**	*Score*	*%*	*Score*	*%*	*Score*	*%*	*Score*	*%*	*Score*	*%*	*%*
1. *General Prof. Educ.*													
Advanced Child Study	89	38	26	48	52	33	59	48	11	39	237	40	41
Curriculum Problems	114	47	24	48	45	29	55	45	17	61	255	43	46
Guidance and Evaluation	126	54	22	41	74	47	73	60	18	64	313	53	53
Philosophy of Education	59	25	10	19	82	53	42	34	15	54	208	35	37
Educational Psych.	63	27	20	37	87	56	54	44	12	43	236	40	41
Soc. Found. of Educ.	32	14	18	33	50	32	37	30	7	25	144	24	27
2. *Specialized Fields:*													
a. Health Education Superv. and Admin.	92	39	15	28	39	25	57	47	18	64	221	37	41
Comm.—Schl. Relations	92	39	25	46	64	41	76	62	18	64	275	46	50
Curric. Construction	100	43	17	31	60	38	56	46	21	75	254	43	47
Pers. and Com. Health	67	29	14	26	39	25	56	46	15	53	191	32	36
Research in Child Growth	35	15	10	19	48	31	41	34	12	43	146	25	28
Indiv. Problems in H. Ed.	76	32	16	30	72	46	46	38	15	53	215	38	40
b. Physical Ed. Organization & Admin.	117	50	11	20	49	31	60	49	17	61	254	43	42
Corrective Phys. Ed.	116	50	18	33	59	38	69	57	13	46	275	46	45
Superv. of School Prog.	90	38	20	37	57	36	48	39	15	53	230	39	41
Meas. and Eval.	106	45	17	31	52	33	62	51	20	71	257	43	46
Activity Prog. Clinics	83	35	15	28	39	25	41	34	9	32	187	31	31
Curric. Construction	127	54	16	30	48	31	47	39	19	68	257	43	44
Individ. Problems in P.E.	73	31	15	28	52	33	46	38	14	50	200	34	36
c. Recreation Education Outdoor Ed. Prog.	118	50	23	43	75	48	62	51	20	71	298	50	53
Organization and Admin.	119	51	12	22	45	29	50	41	18	64	244	41	41
Trends in Rec. Activ.	57	24	11	20	44	28	49	40	13	46	174	29	32
Appraising Com. Resour.	65	28	20	37	58	37	48	39	15	53	206	35	39
Correlation: Schl-Com.	97	41	19	35	55	35	59	48	14	50	244	41	42
Camp Leadership and Adm.	99	42	16	30	50	32	41	34	17	61	223	38	40
Philosophy and Prin.	39	17	10	19	18	12	28	23	13	46	108	18	23

Appraising Com. Resour.	65	28	20	37	58	37	48	39	15	53	206	35	39
Correlation: Schl-Com.	97	41	19	35	55	35	59	48	14	50	244	41	42
Camp Leadership and Adm.	99	42	16	30	50	32	41	34	17	61	223	38	40
Philosophy and Prin.	39	17	10	19	18	12	28	23	13	46	108	18	23
B. *Cultural Fields:*													
1. Fine Arts													
Aesthetic Prin. in Mus., Lit.	54	23	10	19	33	21	40	33	4	14	141	24	22
Music in History	23	10	6	11	29	19	18	15	3	11	79	13	13
Adv. Hist. and Apprec.—Art	32	14	12	22	24	15	21	17	5	18	94	16	17
Adv. Graphic Arts	10	4	12	22	3	2	11	9	5	18	41	7	11
2. English													
Literary Criticism	45	19	7	13	16	10	19	16	2	7	89	15	13
A Period of Amer. Lit.	43	18	8	15	19	12	19	16	3	11	92	15	14
Speech Arts	104	44	20	37	54	35	65	53	11	39	254	43	42
Creative Writing	54	23	14	26	23	15	27	22	9	32	127	21	24
3. Mathematics													
Concepts of Higher Math.	43	18	3	6	22	14	22	18	3	11	93	16	13
History of Math.	9	4	7	13	21	13	12	10	1	4	50	8	9
4. Social Studies													
Hist. and Geog. Latin Amer.	21	9	6	11	36	23	30	25	3	11	96	16	16
Global Geography	30	13	12	22	35	22	52	43	8	29	137	23	26
Periods of Amer. History	38	16	9	17	24	15	29	24	5	18	105	18	18
The U. S. and the World	88	38	23	43	59	38	65	53	11	39	246	42	42
Field Work in Soc. Studies	20	9	15	28	43	28	34	28	6	21	118	20	23
Soc. and Econ.	75	32	13	24	40	26	50	41	11	39	189	32	32
5. Science													
Human Biology	109	47	18	33	50	32	67	55	13	46	257	43	43
Adv. Earth Science	18	8	9	17	14	9	21	17	2	7	64	11	12
Nature Study	40	17	13	24	51	33	43	35	10	36	157	27	29
Air Age Science	69	29	17	10	61	39	48	39	5	18	200	34	27
Elements of Bio-Chem.	46	20	6	11	17	11	25	20	6	21	100	17	17
C. *Study in Integrated Fields:* (Perhaps 6 sem. hrs. each)													
New York State (science, geography, history, lit.)	48	21	13	24	56	36	48	39	2	7	167	28	25
Elementary School (Prof. subject matter, school problems, etc.)	73	31	7	13	45	29	52	43	9	32	186	31	30
Lab. and Field studies in Sci. (Physics, Biology, etc.)	42	18	16	30	25	16	35	29	5	18	123	21	22
Fine and Creative Arts (Hist., expression, etc.)	40	17	13	24	20	13	29	24	5	18	107	18	19
Expressive Arts (speech, radio, drama, etc.)	82	35	18	33	46	29	54	44	12	43	212	36	37
U. S. in the World of Nations	64	27	19	35	61	39	54	44	7	25	205	35	34
Understanding your Community	72	31	18	33	71	46	71	58	10	36	242	41	41

* Scores and percentage ratings appearing in the table are based on a total possible 594 "X marks" on 297 returns, e.g., a score of 120 indicates a total of 120 "X marks.")

though this view was held by three of the five groups of respondents it was held neither by the faculty members nor by teachers in the field. College faculty members held "advanced child study" and "curriculum construction" to be most important. Teachers in the field considered their present most important short-comings to be in the areas of "educational psychology" and "philosophy of education."

Health Education

In the specialized field of health education the equally weighted composite ratings reveal "supervision and administration" of greatest importance with "community-school relations" a close second. However, teachers in service in New York state believe their greatest need to be in the area of "community-school relationships" in health education with "curriculum construction" a close second, after opportunity for work on individual problems in health education has been provided.

Physical Education

Tabulation of the returns on the course areas in the specialized field of physical education reveals needs to be greatest in "measurement and evaluation," "corrective physical education," and "curriculum construction," with importance percentage ratings of 46, 45 and 44, respectively, when each of the five described classifications of respondents is assessed equal weight. However, both teachers in the field and public school administrators believe present needs of physical education teachers to be primarily in the areas of "corrective physical education." Public school administrators believe the next greatest need to be in "measurement and evaluation," with the area of "organization and administration" ranking third in their estimation of physical education teachers' needs.

It is interesting to note that graduating seniors who had yet to gain experience in full-time teaching positions believed their greatest need to be in "curriculum construction." This need was also reported by college administrators in their "importance ratings" as second only to "measurement and evaluation."

Recreation Education

The "outdoor education program" was regarded by every group, except the graduating seniors, as the area in which needs were greatest in the recreation area. Graduating teachers felt their needs in this area and in the area of "organization and administration" to be practically identical. It is interesting to note that inspection of the tables shows a comparatively small number in each of the five different classifications who recognize need for "philosophy and principles" in the field of recreation. The one exception might be the group of college administrators.

Cultural Field

Needs of teachers of specialized subjects in understanding aesthetic principles of music, literature, and other arts were recognized as most important in the area of Fine Arts. In the area of English, "speech arts" and "creative writing" were considered to be most important and in the order mentioned. Teachers' needs in mathematics were felt to be in their failure to comprehend concepts of higher mathematics. In the area of Social Studies the need of an understanding of the "United States and the World" was undoubtedly considered to be of greatest import. This opinion was also borne out in the comments submitted by respondents. Human biology was accorded first importance as a need of teachers in the science area.

Study in Integrated Fields

Importance ratings assigned to seven proposed opportunities for study in integrated fields indicate the most important need to be in the area of "understanding your community." Secondary in importance in the seven integrated fields was the area of "expressive arts," and ranking third was the "United States in the World of Nations."

IMPLICATIONS OF THE SURVEY

Inasmuch as advanced study in health education, physical education, and recreation education on the graduate level is increasing throughout the country it is believed all or some parts of the results of this survey would probably be of interest to professional members of the AAHPER whose responsibilities include direction of undergraduate and/or graduate programs in various educational institutions. On the other hand, those members who are considering advanced study may find it valuable to check their own qualifications against the needs of teachers as recognized by different groups listed in this report.

At the outset, it should be recognized that this survey was not done on a national scale, nor does the committee responsible for its origin propose the thesis that it expresses all of the needs of teachers which might be met in a graduate program. However, it is believed that the survey represents a fair sampling of the groups described, at least in New York state, and that it does have value, as such, in indicating the direction for our graduate programs if they are to be functional and practical in meeting the needs of teachers.

An Action Current Study of Contraction-Movement Relationships in the Tennis Stroke

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(Submitted for publication, November, 1948)

INTRODUCTION

EFFECTIVE teaching in physical education is based upon competent teaching of the motor skills. Thus teaching competence depends on adequate knowledge and understanding of the structure and motor functioning of the human organism. This understanding, in turn, stems back to the fundamental science of kinesiology."

The above statement by C. H. McCloy (4) summarizes at least two long-accepted conclusions to the effect that: (1) physical education is concerned primarily with teaching people to function successfully and efficiently in motor skills, and (2) successful teaching of motor skills is dependent, at least in part, on understanding the nature of movements; *viz.*, the musculatures involved in producing specific movements, the coordination of these musculatures, etc.

Up to recent years, an understanding of the musculatures involved in motor skills and the coordination of these musculatures has been dependent principally upon a knowledge of anatomy, of muscle origin, insertion, line of pull, etc. While the conclusions reached by this procedure have generally been based on sound principles of mechanics, the program has often lacked an important feature of scientific procedure, the feature of experimental verification. Application of the action current technique to kinesiological problems, however, has now made it possible to include this critical aspect of scientific procedure in the muscular analysis of motor skills. This technique provides not only a means of experimental verification, but it also provides an objective method of studying the most minute details of contraction-movement relationships.

The purpose of this investigation was to obtain objective data on the contraction-movement relationships during the tennis forehand drive. As far as can be ascertained there have been no experimental studies of this skill.

The experimental work covered in this paper was completed under the direction of C. H. McCloy, State University of Iowa. R. H. Stetson of the department of psychology at Oberlin College provided most of the apparatus and rendered valuable technical assistance.

The muscles investigated were:

Driving Arm

Short head biceps brachii
Long head biceps brachii

Lateral head triceps brachii
Long head triceps brachii

Anterior deltoid
Medial deltoid

Posterior deltoid
Latissimus dorsi

METHOD AND APPARATUS

The limitations of laboratory space and the requirements for movement recording made it necessary to place certain restrictions on the subject's starting position. This was accomplished by having a regulation tennis ball suspended approximately four feet from the floor by means of an elastic cord. The subject faced the ball and assumed the position he felt was comfortable for the stroke. On the signal "Go," the subject shifted his weight to the rear foot and completed what he considered a normal tennis drive.

One member of the University of Iowa's physical education department and four undergraduate students in physical education served as subjects. All subjects had played tennis for several years and could be considered "good" tennis players.

Simultaneous records of arm movements, contact of the tennis racket with the ball, and action currents were taken on a Teledeltos Polygraph. Records of the general type shown in Figure 1 were obtained throughout the study.

The movement of the arm during the forehand drive was recorded by attaching a light glass thread to the wrist. The thread carried a small stainless steel marker and was attached to a section of rubber band at the opposite end. The recording was mechanically reduced by inserting a length of rubber band between the subject and the marker. Although the system recorded only horizontal movement and thus gave simply a projection of the actual excursion, the recording clearly indicated the start of the back stroke, the end of the back stroke, the start of the drive, and the follow through. Details of the recording system have been presented in an earlier publication (5).

Recording the contact of tennis racket with ball was accomplished by covering the ball with fine copper screen wire. When the steel-strung racket came in contact with the ball an electric circuit was completed, activating the contact marker.

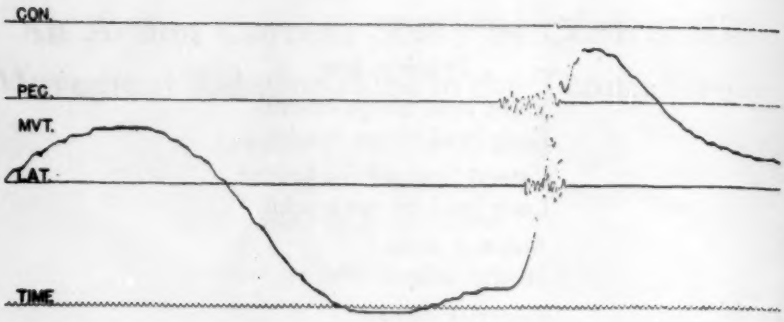

Figure 1. Representative Record of Tennis Forehand Drive: Con.—Contact of tennis racket with ball. Pec.—Action currents from pectoralis major. Mvt.—Movement tracing of arm during forehand drive. Upward direction of tracing indicates forward movement of arm. Distortion of tracing due to slight friction between marker and teledeltos paper. Lat.—Action currents from latissimus dorsi. Time—Time line in .02 seconds.

Two action current channels were used throughout the experiment. The action current apparatus and general procedures have been described by Brown (2), Hudgins (3), Sperry (6), and Stetson and Bouman (7).

Time was recorded in .02 seconds on all records.

RESULTS

Of the subjects used in the tennis stroke, four were right-handed and one left-handed. Three hundred records were measured, and the contraction-movement relationships presented represent modal values for at least five recordings from each muscle.

To facilitate presentation of the data, the muscle coordination discussed refer to the muscles of the driving arm, i.e., discussion of the pectoralis major refers to the right pectoralis major for the right-handed subjects and to the left pectoralis major for the left-handed subject. The individual subjects are referred to by the code letters FAR, SCH, CHU, WEN, and ROB.

Long and Short Head of Biceps Brachii.—For subjects CHU, SCH, and WEN, the long and short heads of the biceps functioned more or less as a unit. For subject FAR contractions of the long head were not as extensive as those of the short head. No contractions occurred in the long head of the biceps for subject ROB. For all subjects contractions of the biceps occurred during some phase of the drive and continued into the follow-through. For subject SCH contractions occurred during most of the drive and dropped out shortly after ball contact. For the other subjects contractions began during the latter part of the drive and continued into the follow through.

The position of the right arm at the start of the drive is such that one might expect the biceps to assist in the more or less horizontal swing of the arm forward. The fact that biceps contractions do occur would seem to verify this speculation. Bowen (1, p. 120) on the other hand, suggests that biceps contractions during a horizontal swing of the arm forward may simply serve to protect the elbow against injury from overextension. This latter suggestion would not, however, explain why strong contractions of the triceps often occurred during the forward swing.

Lateral and Long Head of Triceps Brachii.—Contractions of the lateral head of the triceps generally began during the latter portion of the drive and continued into the follow-through. Subjects SCH and CHU exhibited earlier contractions of the lateral head; these contractions occurred throughout a large portion of the back stroke.

Subject WEN showed no contractions of the long head of the triceps during the tennis stroke. For other subjects, contractions began shortly before ball contact and continued into the follow through.

Although it has often been stated in general kinesiological analysis that the elbow is extended passively during the forehand tennis drive, this does not appear to be quite true for the subjects of this experiment. There were strong contractions of the triceps during the drive, and it would seem that they must have contributed to extension of the elbow. It is possible, however, that the action involved more than simple extension.

C. H. McCloy,* for example, has theorized that such action of the triceps probably represents "a phenomenon where the contraction of the biceps is so strong that it would, in addition to swinging the arm forward, also bend the elbow." Strong contractions of the triceps would thus serve the dual purpose of keeping the elbow straight, as the activity demands, and of permitting the biceps to pull at full strength. In his own kinesiological research, McCloy finds similar coordinations in activities where subjects are required to lift weights from a position at the side to a position at the front horizontal with palms up. In these activities there is always strong action of the biceps to assist in raising the arm, but the action of the triceps appears to be dependent on the weight moved. When the weight is great enough to counteract the flexing action of the biceps, no contractions occur in the triceps. When, however, the weight is not great enough to counteract this flexion, strong contractions appear in the medial and lateral heads of the triceps.

Anterior Deltoid.—Considerable variation was shown in the contraction pattern of the anterior fibers of the deltoid during the tennis

* Personal communication.

stroke. For subjects WEN and ROB contractions came in shortly after the start of the back stroke and continued through the first portion of the follow-through. For subject FAR, strong contractions came in at the start of the drive and continued to the end of the stroke. Contractions for subjects SCH and CHU occurred from shortly after the start of the drive to approximately the end of the stroke.

The presumable action of the anterior fibers of the deltoid was to pull the arm forward during the drive. The apparent delay in action of the anterior fibers for some subjects (SCH and CHU) is probably explained in the fact that these subjects used the following sequence in the drive: (1) forward movement of the body which literally dragged the arm forward, (2) rapid movement of the arm from the shoulder at the end of body movement. The other subjects tended to synchronize the forward movement of the body and arm.

Contraction of the anterior fibers during the back stroke for subjects WEN and ROB may represent either a poor coordination or an action to prevent the limb from moving backward too fast or too far.

Medial Deltoid.—For subject WEN contractions occurred in the medial fibers of the deltoid throughout the back stroke, drive, and first portion of the follow-through. The other subjects exhibited two distinct pulses during the stroke; the first occurred throughout most of the back stroke, and the second from shortly before ball contact to the end of the follow-through.

In general kinesiological analysis it is often stated that the medial fibers of the deltoid function throughout the back stroke and drive to maintain the level of the swing. While this is in agreement to some extent with the data on subject WEN, it cannot be said to apply to the other subjects of this experiment. These subjects simply did not show any action of the medial deltoid during a large part of the drive. In these subjects it would seem that as far as the muscles under investigation were concerned, the level of the arm was maintained primarily by action of the anterior deltoid and the long head of the biceps.

Posterior Deltoid.—Subjects SCH and ROB showed two distinct contraction pulses of the posterior fibers of the deltoid; the first pulse occurred during the back stroke, and the second during the first part of the follow-through. For subjects WEN and CHU, contractions occurred only during the back stroke. Contractions for subject FAR occurred only during the follow-through.

The probable action of the posterior fibers during the back stroke was to lift and carry the arm backward. Contractions during the follow-through probably acted as a brake on the arm.

Pectoralis Major.—All subjects exhibited contractions of the pectoralis major during the drive. For subjects SCH, FAR, and CHU, strong contractions occurred from the beginning of the drive to slightly beyond ball contact. For subjects WEN and ROB, contractions began after the start of the drive and continued beyond ball contact.

The pectoralis major, along with the anterior fibers of the deltoid probably functioned to swing the arm forward during the drive.

Latissimus Dorsi.—For subject ROB no contractions occurred in the latissimus dorsi. Subject FAR showed contractions during the middle third of the drive. For subjects CHU, SCH, and WEN, contractions occurred through a large portion of the drive and continued into the follow-through. Observation showed that the arm and racket were generally above the level of the ball at the start of the stroke, and the latissimus dorsi possibly served to lower the arm and racket during the drive.

Another possible explanation for the action of this muscle has been presented by McCloy.* He points out that since the latissimus dorsi is a strong internal rotator of the humerus, contractions during the drive stroke may represent an attempt to put top spin on the ball. While there would be no advantage in attempting to put spin on the ball in this experimental situation, long-established habits may lead to this action.

NATURE OF COORDINATIONS IN TENNIS STROKE

The individual subject exhibited extremely little variation in contraction-movement relationships from stroke to stroke. The variations found were seldom greater than two to three percent. This would seem to indicate that the strokes were well developed habit patterns.

A comparison of contraction-movement relationships between subjects, however, showed extensive variations in timing and general coordination. Figure 2 presents a graphic picture of the variability in coordinations of the several parts of the deltoid. For all muscles investigated, the variations were extensive enough to preclude the formulation of any single statement that could be considered a precise kinesiological analysis of contraction-movement relationships for the subjects of this experiment. These findings are in general agreement with those of an earlier study of the golf stroke (5). While the scope of these two investigations has been too limited for any sweeping generalization, the available experimental data do suggest that the contraction-movement relationships of a motor skill may not be as stereotyped and invariant as they appear in some forms of analyses.

* Personal communication.

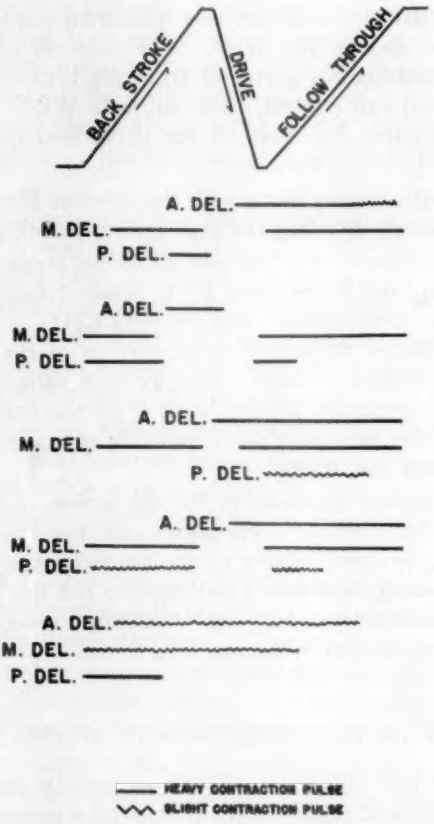

Figure 2. Graphic Summary of the Contraction Incidence of Deltoid During the Tennis Forehand Drive: A. Del.—Contraction incidence of the anterior fibers of deltoid. M. Del.—Contraction incidence of medial fibers of deltoid. P. Del.—Contraction incidence of posterior fibers of deltoid. Dropping vertical lines from any two points on the movement diagram will show the muscle action during that phase of the stroke.

Of the musculatures investigated, the following were found to contract between the forward movement of the arm and ball contact:

Pectoralis major	All subjects
Anterior deltoid	All subjects
Latissimus dorsi	Four subjects
Biceps brachii	Three subjects
Medial deltoid	One subject

Of these muscles it would seem that only the pectoralis major, anterior fibers of the deltoid, and biceps brachii contributed to accel-

eration of the driving arm. The latissimus dorsi and medial fibers of the deltoid probably functioned as synergists.

In one subject, the action of the anterior fibers of the deltoid appeared to be characteristic of the muscle action of ballistic movements; contractions in these fibers commenced during the latter part of the back stroke and continued through approximately the first third of the drive. With this single exception the presumable driving muscles commenced contractions at varying intervals after the start of the drive and generally continued into the follow-through. On the basis of the contraction incidence of the presumable driving muscles, it would appear that the tennis drive is of the non-ballistic type.

SUMMARY

Objective data on the contraction-movement relationships during the tennis forehand drive were obtained for nine accessible muscles or muscle parts.

Results showed that:

1. For the individual subject, the contraction-movement relationships were extremely consistent from one stroke to another.

2. From subject to subject, however, there were extensive variations in timing and general coordination.

3. On the basis of the contraction incidence of the presumable driving muscles, it would appear that the tennis forehand drive is of the non-ballistic type.

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Mental Practice and Physical Practice in Learning a Motor Skill*

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(Submitted for publication, January, 1949)

INTRODUCTION

IN spite of the rapid advancement in the scientific approach to physical education, there is little in the literature to indicate just how much of motor learning is physical and how much is mental. There is little doubt that knowledge of the mental activity required for efficient motor learning would aid physical educators in an understanding of teaching techniques. But the variable of "mental activity" is one which is difficult to isolate and measure. At best it can only be roughly comparable to its given counterpart in physical activity. The very sparseness of reference to this concept in the literature serves all the more to emphasize the importance of this gap in our knowledge.

REVIEW OF THE LITERATURE

Buegel (1) has noted that the introduction of ideational elements facilitates learning in the early stages of motor learning. But the only direct approach is made in a study by Vandell, Davis, and Clugston (3) in an attempt to isolate the effects of mental practice in the learning of a motor skill. Because of the important bearing of this work on the present study it will be described in detail.

A group of 12 senior high school boys practiced 35 standard basketball free throws under one of three conditions:

Condition 1, four boys: on the first and 20th day.

Condition 2, four boys: on each of 20 days.

Condition 3, four boys: on the first and 20th day with 15 minutes of mental practice from the second through the 19th day.

Similar experiments, throwing 25 darts, were given to 12 junior high boys and 12 college freshmen. All subjects were equated in motor ability, mentality, and other factors. Mental practice consisted of "mentally throwing" darts or basketballs at imaginary targets. Percent improvement was measured between the first and 20th day's scores.

* From the Research Laboratories of the Department of Physical Education, University of California, Berkeley. The writer is indebted to Dr. Franklin M. Henry for advice and criticism during the course of this investigation.

High school boys shooting basketball free throws improved two percent under Condition 1, 41 percent under Condition 2, and 43 percent under Condition 3. The junior high school boys throwing darts improved a minus two percent under Condition 1, plus seven percent under Condition 2, and four percent under Condition 3. The college freshmen made no improvement under Condition 1, 23 percent improvement under Condition 2, and 22 percent improvement under Condition 3.

The authors concluded that mental practice was about as effective as physical practice under the conditions of this experiment.

In the absence of a statistical analysis of results, independent verification of findings seemed to be necessary before a reliable evaluation could be made. Furthermore it seemed desirable to make this test in a different motor activity so that more generalization would be possible.

The experiment formulated by the present writer was designed to examine the statistical significance of the difference in the learning of a motor skill through mental practice as differentiated from physical practice.

PROCEDURE

A group of 36 college men, selected at random, practiced a ring-toss experiment under one of three conditions:

Condition 1: twelve subjects threw 210 rings on the first and 22nd days.

Condition 2: twelve subjects threw 210 rings on the first day, 70 rings each day from the second through the 21st day, and 210 rings on the 22nd day.

Condition 3: twelve subjects threw 210 rings on the first day, mentally rehearsing their first day's activity for 15 minutes daily from the second through the 21st day, and 210 rings on the 22nd day.

The apparatus consisted of seven rope rings, with a six-inch diameter, made of five-eighths inch manila hemp bound at the joints with friction tape. The target was a round wooden peg one foot high and one inch in diameter, mounted vertically on a base made of quarter-inch plywood. This target was placed ten feet from a restraining line behind which the subjects stood when tossing. Each subject was given uniform instruction by the experimenter. This included stance, with foot forward corresponding to the throwing arm; grip, between thumb and first two fingers; and arm action, with elbow flexed and ring held at chin level. The experimenter then demonstrated by throwing seven sample tosses at the target, to show the general flight of the ring.

The subject, without any practice, then tossed rings one at a time until all seven had been thrown. On a prepared scoring form

he recorded the number of rings which encircled the peg. A strong desire to improve was maintained as he recorded his own score. Under the supervision of the experimenter the subject retrieved the rings and continued until all 210 had been thrown.

Each subject was further instructed to refrain from discussing, thinking about, watching, or practicing the task between practice periods. It was emphasized that any extra practice must be noted on the score sheet. All practice periods took place at about the same time each day.

The subjects under Condition 3 were instructed to mentally rehearse their initial test, trying to visualize all of the sensations that they went through. They were cautioned to perform no overt movements but to actually "mentally throw" rope rings at imaginary targets.

RESULTS

Improvement was measured by the difference in scores between the first practice day and the 22nd practice day and is shown in Table I.

TABLE I

	No. of Subjects	*Practice Periods*	*Mean 1st Day Score*	*Mean 22nd Day Score*	*Percent Improvement*	*C.R. (t-ratio)*
Condition 1 (no practice)	12	2	36.5	38.1	4.3	0.83
Condition 2 (physical)	12	22	28.4	67.4	137.3	6.44
Condition 3 (mental)	12	22	38.7	51.5	36.2	3.8

Measured in percentages, Condition 1 (no practice) resulted in 4.3 percent improvement, while Condition 2 (physical practice) resulted in 137.3 percent improvement, and Condition 3 (mental practice) resulted in 36.2 percent improvement.

The critical ratios indicate that Condition 1 ("t" = 0.83) resulted in only chance improvement.* The improvement under Condition 2 ("t" = 6.44) was clearly significant. The same was true for Condition 3 ("t" = 3.8).

DISCUSSION

It would appear that physical and mental practice are both means of facilitating the learning of motor skills. In this experiment there was no method of truly equating the amount of practice under these two conditions. The mental practice periods were for fifteen minutes

* Small sample statistics were used. With the number of subjects used, a "t" ratio of 2.2 is significant (p.=.05) and one of 3.1 is highly significant (p.=.01). (See J. P. Guilford, *Fundamental Statistics in Psychology and Education*, New York: McGraw-Hill, 1942).

daily while physical practice involved tossing seventy rings at whatever rate the subject desired. The time required to toss seventy rings ranged from about five to ten minutes, averaging about seven and one-half minutes, or only half the time spent by the mental practice group. Furthermore, introspective comments recorded by subjects during mental practice indicate that genuine mental effort was effective for only about the first five minutes of each practice period. Beyond this concentration became increasingly difficult.

The mental practice period was usually spent in actively "mentally picturing" the entire ring-tossing procedure. Occasionally subjects reported attempts at working out new "'theories" of tossing in hopes of improving performance. Several such "theories" were unsuccessful during the final test forcing the subject to revert to his original style.

The reasons for motor improvement as a result of mental practice is somewhat obscure. Implicit muscular activity during mental activity has been reported by Freeman (2). It is possible that coordination was improved by such implicit muscular activity.

SUMMARY AND CONCLUSIONS

A group of 36 college men was presented with a ring-toss experiment. After an initial test they were divided into three groups. One group practiced no more for 21 days. Another group had physical practice tossing rings for 21 days. A third group mentally rehearsed ring tossing for 21 days. On the 22nd day all subjects repeated the initial test.

Subjects receiving no practice showed no significant learning. The group receiving physical practice improved 137 percent and the group receiving mental practice improved 36 percent. In both of these groups the improvement was statistically significant.

It should be mentioned that the subjects were not equated as to ability to learn gross bodily motor skills nor as to general motor ability.

It is concluded that both mental and physical practice under the conditions of this experiment are effective in facilitating the learning of a simple motor skill.

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Research Abstracts

Prepared by the

RESEARCH ABSTRACTS COMMITTEE OF THE
NATIONAL COUNCIL OF THE RESEARCH SECTION
CAROLYN W. BOOKWALTER, *Chairman*

EDUCATION

Fattu, Nicholas A., and William H. Fox. Scores on the interpretation of data test: their relationship to measures of achievement, personality, and interest. *Bulletin of the School of Education,* Indiana University, 25:1 (May, 1949).

Three hundred and four ninth-grade children in two representative Indiana high schools were measured on the following aspects: chronological age, general ability, reading, mathematics, social studies, science, health knowledge, quality of school work, interests, social competency, personal adjustment, and socio-economic status.

Age did not have a significant association with general accuracy. General accuracy ability to interpret data seemed to be related to factors of intelligence and achievement both in terms of standard tests and of classroom work. The correlation between health knowledge and general accuracy was positive while the correlation between health knowledge and caution was practically nonexistent. The correlation for the health knowledge and the tendency to go beyond the data in interpreting data was negative and highly significant.—*Carolyn W. Bookwalter.*

HEALTH

Shinners, B. M., R. F. Krauss, and B. A. Rochester, Encephalitis in children with electroencephalographic changes. *New York State J. of Med.,* 49(18) :2140-2144, 1949.

The study presents encephalograms of five children with encephalitis "due to measles, mumps, chickenpox, herpes simplex." It suggests that childhood diseases can produce permanent damage to the brain resulting in behavior problems and convulsive activity. These selected subjects showed electrical abnormality of the brain "even after the clinical state was considered normal."—*Alma C. Kelly.*

Whittingham, Sir Harold, A. B. Barbour, and J. C. Macgown. Medical fitness for air travel. *Modern Medicine,* 17(18) :49-55, 1949.

Advice on the contraindications to travel by air is given in a detailed table. Limitations of various medical conditions and recommendations regarding air travel are specified.—*Alma C. Kelly.*

NUTRITION

Burke, Bertha, Stuart S. Stevenson, Jane Worcester, and Harold Coe Stuart. Nutrition studies during pregnancy. V. Relation of maternal nutrition to condition of infant at birth: Study of siblings. *J. Nutrition,* 38.4 (August, 1949).

The physical condition of 68 siblings born to 57 of the 216 women studied in a previously published series of cases has been studied in relation to the maternal dietary rating for the latter part of these subsequent pregnancies.

1. In 284 (216 original + 68) cases when the maternal diet was "excellent or good," 95 percent of the infants were in good or excellent physical condition at birth and only 5 percent were in either fair or poorest physical condition. In contrast, when the maternal diet was "poor to very poor" 65 percent of the infants were in poorest physical condition, 27 percent were in fair condition, while only 8 percent were in good or excellent physical condition at birth.

2. Average birth weight and length of infant decreased as the maternal diet became poorer.

3. Improvement of the infant's condition with improvement of the maternal diet and deterioration of the infant's condition with deterioration of the maternal diet appeared in this series of matched pairs of siblings where each of 53 mothers was observed through two pregnancies. While the changes were not sufficiently striking to be statistically significant, this series of matched siblings is unique since each mother has been used as her own control and thus hereditary and environmental variables in part have been minimized. —*Wistar Institute.*

Harris, Jimmie Nell, and Florence I. Scoular. Riboflavin metabolism of young women on self-selected diets. *J. Nutrition,* 38:4 (August, 1949).

Many investigators have determined the urinary riboflavin excretion values of young women, but few have done so on self-chosen diets of known riboflavin content. The purpose of this study was to determine the riboflavin value of food and of excreta of young college women consuming a self-selected diet from a common food supply. Conner and Straub's method (1941) was used in determining the riboflavin content of milk, food, and feces, while Ferrebee's (1940) was used in determining urinary riboflavin. The self-chosen diets ranged from an average of 1,247 to an average of 2,469 μg. The 9 subjects excreted from 36 to 51 percent of the intake prior to the 5-mg supplement which was given in one period. Five subjects were given the supplement: one subject returned 24 percent; three, 32 to 36 percent; and one, 44 percent. The average daily fecal output of 5 subjects ranged from 515 to 954 μg. The total output of these subjects was less than the intake.—*Wistar Institute.*

Kemmerer, Arthur R., and Rosalie Acosta. The essential amino acid content of several vegetables. *J. Nutrition,* 38:4 (August, 1949).

The content of the 10 essential amino acids was determined in broccoli, two varieties of cauliflower, four varieties of sweet corn, and nine varieties of carrots. If it is assumed that the amino acids are present in whole egg in optimum proportions, the proteins in all these vegetables are deficient in isoleucine and lysine. Cauliflower protein is definitely optimum in methionine, valine, threonine, histidine, tryptophan, and possibly phenylalanine and arginine. Broccoli is optimum in only arginine and methionine. Sweet corn is approximately optimum in histidine, leucine, phenylalanine, and valine. Carrot protein is deficient in all the essential amino acids. The percentages of any one of the amino acids in the vegetable proteins varied in the different samples of each vegetable. This variation is not attributed to varietal difference.—*Wistar Institute.*

Levertin, Ruth M., and Mary Rose Gram. Nitrogen excretion of women related to the distribution of animal protein in daily meals. *J. Nutrition,* 39:1 (September, 1949).

The nitrogen metabolism of 14 college-age women on a controlled diet which included no animal protein in the breakfast, was compared with their nitrogen metabolism when the breakfast included 8 oz. of milk, although the total protein intake remained unchanged.

During period A, when no animal protein was included in the breakfast, the average daily urinary excretion for all subjects was 9.02 gm. nitrogen, S.D. 0.410, as compared with 8.33 gm., S.D. 0.290, during period B when animal protein from 8 oz. of milk was furnished with the breakfast. The difference in urinary excretion was 0.69, S.E. 0.134. In period A the average daily nitrogen absorption was —0.4 percent as compared with 10.3 percent in period B. The average daily nitrogen was —0.03 gm. in period A as compared with 0.96 gm. in period B.

In view of the nature and significance of the findings, it is possible that the distribution of quality and kind of protein in three meals, as well as the total daily amount of protein must be considered in determining protein requirements and utilization.—*Wistar Institute.*

Schlaphoff, Doretta M., and Frances A. Johnston. The iron requirement of six adolescent girls. *J. Nutrition,* 39:1 (September, 1949).

Six girls, 13 and 14 years of age, were fed a controlled diet for 9 weeks. An adjustment period of one week was followed by a 4-week period during which their daily intake was approximately 8.6 mg. of iron. During an additional 4-week period the average intake was 11.7 mg. The retention required by the subjects was calculated by adding together the amount needed to replace iron lost in the menses as determined by analysis and the amount needed for growth based on estimates of Heath and Patek (*Medicine,* 16:267, 1937). The minimum retentions required daily were 0.62, 0.64, 0.75, 0.96, 113, and 189 mg. When the average intake was 8.6 mg., retentions of the six girls were 0.80, 0.86, 1.22, 1.23, 1.42, and 1.54 mg. per day. Five of these six retentions were larger than the minimum amount required. When the average intake was 11.7 mg., retentions were 0.33, 1.15, 1.54, 1.76, 2.10 and 2.22 mg. per day. On this latter intake, retentions were larger than those required, large enough to allow a wide margin of safety, except for one subject whose retention appeared to be atypical.

On this basis of the six cases studied, a dietary intake of 12 or 13 mg. per day is recommended for girls of this age until more cases have been studied.—*Wistar Institute.*

PHYSIOLOGY

Bean, W. B. An analysis of subjectivity in the clinical examination in nutrition. *J. Appl. Physiol.,* 1:458-468, 1948.

During a nutritional experiment on 513 men, a team of physicians endeavored to detect the early symptoms of malnutrition. Although a set of objective standards was used, there was considerable difference in evaluation of signs by different examiners. This emphasizes the uncertainty of the clinical evaluation and the inexactness of clinical data dealing with diagnosis of the beginning of deficiency diseases.—*P. V. Karpovich.*

Bruce, R. A., F. W. Lovejoy, Jr., P. N. G. Yu, R. Pearson, and E. B. Emerson. Recent developments in the physiologic study of patients with chest diseases. *New York State J. of Med.* 49(18): 2133-2139, 1949.

In this physiologic study of chest diseases, various methods are applied on four specific cases. Chest roentgenograms, bronchospirometric tracings and exercise performance tracings (treadmill) are shown. The reliability of exercise tolerance tests in estimating the patient's disability and in differentiating pulmonary and circulatory inadequency is discussed.—*Alma C. Kelly.*

Cohen, L., G. M. Martin, and K. G. Wakin. Effects of whirlpool bath with and without agitation on the circulation in normal and diseased extremities. *Arch. Physic. Med.,* 30(4):212-219, 1949.

Twenty men were studied: 11 normal, five with flaccidity of the upper extremities, four with various degrees of atrophy of the upper extremities. The blood flow was measured by means of venous occlusion plethysmograph. Half-hour baths from 38.6 to 42.5° C. caused an increase in the blood flow lasting about 45 minutes after the treatment. Identical results were obtained whether water in the bath was stationary or agitated.—*P. V. Karpovich.*

Darling, R. C. Some metabolic observations during and after exercise in patients convalescing from acute illnesses. *Arch. Physic. Med.*, 30(2):71-77, 1949.

Observations were made on eight patients recuperating from pneumonia, rheumatic fever (adult type), infectious hepatitis, and rickettsiapox. Patients were tested during the first two days of ambulation and again eight weeks later. Exercise consisted of walking for five minutes on the laboratory floor, 1-2 hours after breakfast. The Douglas-Haldane method was used. Blood from the finger was also taken for sugar and lactate determinations. Oxygen consumption, and blood sugar content were not affected by the convalescent state. The pulse rate and the lactate content after exercise were higher at the beginning of convalescence than some weeks later.—*P. V. Karpovich.*

Fischer, E. Potassium in denervated, treated and nontreated muscle. *Arch. Physic. Med.* 30(6): 375-382, 1949.

Denervation atrophy causes a progressive decrease in potassium content of the true muscle space. The extractable myosin is also proportionately reduced. Sodium partly replaces potassium. These changes happen seldom if ever in atrophy caused by tenotomy or by a cast. Daily electrical treatment of denervated muscle not only prevents potassium loss, but may even cause an increase in its concentration.—*P. V. Karpovich.*

Franseen, E. B., J. E. Finesinger, and A. L. Watkins. The response of psychoneurotic patients and normal men and women to brisk submaximal exercise. *Arch. Physic. Med.*, 30(4):219-233, 1949.

Normal and psychoneurotic men and women were given a three-minute step-up test. The rate of stepping was adjusted to the weight so that the total amount of work was 15,000 foot pounds for men and 9,200 foot pounds for women. The following were investigated: O_2 consumption, pulmonary ventilation, blood lactate, heart rate. There was no significant difference found in data obtained on the patients and the well subjects. Patients, however, had a greater resting pulmonary ventilation than normal. This difference was absent during exercise and recovery.—*P. V. Karpovich.*

Hollander, J. L., and S. M. Horvath. Changes in joint temperature produced by diseases and by physical therapy. *Arch. Physic. Med.* 30(7):437-440, 1949.

For temperature measurement, a thermocouple was inserted deep inside the joint. Thirty-five knee joints and one elbow joint were investigated. Infrared heat for 30 minutes slightly elevated the temperature. Short-wave diathermy caused a mean increase of 7.7° F. Hot pack invariably caused a decrease, as much as 2.2° F. Cold packs increased joint temperature. Application paraffin caused an increase in temperature. After exercise, joint temperature increased, but rapidly came back to normal.—*P. V. Karpovich.*

McClellan, W. S., and C. R. Comsock, Jr. The cutaneous absorption of radon from naturally carbonated water baths. *Arch. Physic. Med.* 30(1):29-36, 1949.

Two subjects were used. It was found that radon is absorbed through the skin. Radon in water containing carbon dioxide is absorbed better than when combined with plain water. (Concentration was 35-75 microcuries in 200 L. of water.) Radon is also absorbed through inhalation of the air above the bathtub. Radon is eliminated in about three hours.—*P. V. Karpovich.*

Wakim, K. G., G. M. Martin, J. C. Terrier, E. C. Elkins, and F. H. Krusen. The effects of massage on the circulation in normal and paralyzed extremities. *Arch. Physic. Med.* 30(3):135-144, 1949.

Two types of massage were used: first, a modified Hoffa type consisting of deep stroking and kneading; second, "a vigorous, forceful, stimulating massage, employing extremely deep stroking, kneading, and friction." The blood flow was measured by means of venous occlusion plethysmograph with the compensating spirometer recorder. The first type of massage had no consistent or significant effect on the circulation of normal subjects or those with rheumatoid arthritis and spastic paralysis, but caused an increase in circulation in patients with flaccid paralysis. The second type (vigorous) massage caused an increase in the blood flow of the massaged extremity.—*P. V. Karpovich.*

PSYCHOLOGY

Ammons, R. B. Acquisition of motor skill: II. Rotary pursuit performance with continuous practice before and after a single test. *J. Exp. Psychol.*, 37:393-411, 1947.

College women (N=510) were given practice on a pursuit rotor for periods ranging from 1/3 to 17 minutes, rested for periods ranging from 1/3 minute to six hours, and then given eight minutes' additional practice. It was found that reminiscence (improvement without practice) was a negatively accelerated function of interpolated rest, reaching a maximum with eight minutes of practice and five minutes' rest. Recovery from work neared its maximum with 20 minutes' rest, and was an exponential function of time. Maximum accuracy during the standard eight minutes' post-rest practice period was influenced by the duration of the interpolated rest, being greatest when the rest was between five and 20 minutes. Individual curves were extremely variable.—*F. Henry.*

Cruickshank, W. M., and J. E. Dolphin. A study of the emotional needs of crippled children. *J. of Educ. Psychol.*, 40: 295-305 (May, 1949).

This study was undertaken in order to provide greater insight into the psychological changes which have occurred in physically handicapped children. Subjects were eighty-seven children with orthopedic or neurological defects, ranging in age from nine to nineteen, including forty-two boys and forty-five girls.

Rath's Self-Portrait-N Test (a test of emotional needs) was administered to the group and the results treated by analysis of variance methods.

Comparisons were made between three clinical groups of children, those with cerebral palsy, cardiac conditions, and poliomyelitis. Significant differences obtained indicated that cardiac and poliomyelitis cases had more feelings of fear than cerebral palsy children. Statistically significant results were not found between the scores of boys and girls, with the exception (2-5 percent level of confidence) that the need to achieve is more satisfactorily fulfilled in girls than boys.

Considering all the children as a group, the need to share in decision making and the need for love and affection were being overmet by the adults in the child's environment. At all ages the crippled child evidences a need to be free from feelings of fear.

Tentative norms established for the Self-Portrait-N Test indicate that responses of crippled children are comparable to those expected from normal children on such items as need to belong, to achieve, to have economic security, to be free from feelings of guilt, and to understand the world. —*Marjorie Phillips.*

Nance, R. D. The effects of pacing and redistribution on intercorrelations of motor abilities. *J. Exp. Psychol.*, 37:459-472, 1947.

Research in the field of motor ability has persistently indicated that most intercorrelations between motor skills are positive but low. Certain factors such as heterogeneity of maturity and others such as common musculature used in performance may operate to increase intercorrelations in narrow group factors. The present study investigates the influence of *pacing* and *distribution of practice* on the intercorrelations between scores from a rotary pursuit test and a complex coordination test given to some 400 college students. The use of a common procedure in the two tests, e.g., pacing (or distributed practice) failed to increase the intercorrelation. In fact, the correlations were somewhat higher when the conditions were dissimilar in the two tests. Test reliabilities were slightly higher for paced work and distributed practice. —*F. Henry.*

Postman, L., and W. O. Jenkins. An experimental analysis of set in rote learning: The interaction of learning instructions and retention performance. *J. Exp. Psychol.*, 38:683-689, 1948.

Learning efficiency is greatly impaired if there is neither explicit nor self-induced instruction to learn. The results of the present experiment reaffirm the importance of set as a basic determiner of learning performance.

Twenty-five two-syllable adjectives were presented five times to 215 subjects. Set was varied toward anticipation, free recall and recognition, and retention was tested by these three methods to test the hypothesis that performance would be optimal if the retention test was the one expected and poor if the test was of an unexpected type.

The results show that learning is improved to the extent that the instructions emphasize those aspects of the learning tests that are to be used in the retention test, and impaired to the extent that the instructions and retention problem fail to harmonize.—*F. Henry.*

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Administration and Supervision: Richard Hayes.
Aquatic: Jack Hewitt.
Athletics—Boys and Men: Lloyd Messersmith.
Athletics—Girls and Women: Martha Gable.
Camping and Outdoor Education: Margaret McCall.
Dance: Alma Hawkins.
Measurement and Evaluation: Joy W. Kistler.
Professional and Public Relations: C. O. Jackson.
Professional Education: Rosalind Cassidy.
Research: Carolyn Bookwalter.
Student: Marvell Hancock and Douglas Conner.
Therapeutics: Leah J. Gregg.

District Association Presidents

Central: M. Gladys Scott.
Eastern: Thomas C. Ferguson.
Midwest: Lou H. Hollway.
Northwest: Grace Houghton.
Southern: Solon B. Sudduth.
Southwest: Frank R. Williams.

State Representatives

Central District

Colorado (2): (No report).
Iowa (2): E. F. Voltmer; Frank D. Sills.
Kansas (2): Fritz Knorr; Sue Unruh.
Minnesota (2): Perry J. Sandell; Clarence A. Nelson.

Missouri (2): Deane Smith.
Nebraska (1): Mrs. Herman Gimmestad.
North Dakota (1): Beatrice Wartchow.
South Dakota (1): R. B. Frost.
Wyoming: (None).

Eastern District

Connecticut (2): (No report).
Delaware (1): George W. Ayars.
District of Columbia (2): Joseph Krupa; Mrs. Clarice O. Smith.
Maine (1): (No report).
Maryland (2): (No report).
Massachusetts (3): (No report).
New Hampshire (1): Harry Lehmann.
New Jersey (3): R. Warren Fogerty; Dorothy Simpson; Gerald Garafola.
New York (6): Ellis Champlin; Marie Schuler; John H. Shaw; Jeannette Saurborn; Lloyd Appleton; Carl E. Willgoose.
Pennsylvania (4): Karl C. H. Oermann; Lowell C. Drake; Elmer B. Cottrell.
Rhode Island (1): A. Victor Skonberg.
Vermont (1): (No report).

Midwest District

Illinois (4): Ray O. Duncan; Clifford Horton; Ruth E. Lins; Jane Axtell.
Indiana (2): Robert Yoho; Karl Bookwalter.
Michigan (3): Gladys D. Ferguson; Joe Moran; Julian Smith.
Ohio (3): Edwina Jones; Paul E. Landis; Carl T. Nuessley, Jr.
West Virginia (1): Ott Romney.
Wisconsin (2): (No report).

Northwest District

Idaho (1): (No report).
Montana (1): Inga A. Hoem.
Oregon (2): (No report).
Washington (2): Lee Rankin; Virginia L. Shaw.

Southern District

Alabama (1): Mrs. Jessie Garrison Mehling.
Arkansas (1): (No report).
Florida (2): T. J. Bleier; Louise Smith.
Georgia (2): Ernest B. Smith; Mary Ella Soule.
Kentucky (2): (No report).
Louisiana (2): (No report).
Mississippi (1): (No report).
North Carolina (2): Ruth White Fink; Charles E. Spencer.
Oklahoma (1): (No report).
South Carolina (1): (No report).
Tennessee (2): A. W. Hobt; Solon Sudduth.
Texas (3): Helen Byington; W. M. Dowell; Otho M. Polk.
Virginia (2): Harld K. Jack; Alfred D. Hurt.

Southwest District

Arizona (1): (No report).
California (4): (No report).
Nevada: (None).
New Mexico (1): John T. Gunn.
Utah (1): Elizabeth Dutton.

Affiliated Organizations

American Academy of Physical Education: Frederick W. Cozens.
American Physiotherapy Association: Esther Gilman.
American School Health Association: C. H. Keene.
American Youth Hostels, Inc.: Ben W. Miller.
Association for Physical and Mental Rehabilitation: Sam Boruchov.
Boys' Club of America, Inc.: Walter M. Hall.
Canadian Physical Education Association: A. S. Lamb.
College Physical Education Association: L. Carroll Adams.
Delta Psi Kappa: Elizabeth Moore.
National Association of Physical Education for College Women: Irene Clayton.
National Collegiate Athletic Association: Frederick W. Leuhring.
Phi Delta Pi: Mary Elizabeth McCoy.
Phi Epsilon Kappa: W. K. Streit.
Physical Education Society of the YMCA's of North America: Marshall L. Walters.
Society of State Directors of Health, Physical Education, and Recreation: Ray O. Duncan.
YWCA Health Education Directors' Society: Mary M. Weeks.

Index for Volume XX (1949)

(Cumulative Author, Subject Matter, and Title)

Numbers refer to number of issue first and page number second. For example, 3:250 refers to October, page 250. Number 1 is March; number 2, May; number 3, October; number 4, December. No supplements to Volume XX were published.

Achievement Scale Scores for High School Swimming. Jack E. Hewitt. 2:170.

Action Current Study of Contraction-Movement Relationships in the Tennis Stroke, An. Arthur T. Slater-Hammel. 4:424.

ANDERSON, Jackson M. The Development of Personnel Standards for Leadership Duties in Public Recreation. 3:273.

ATHLETICS

- Action Current Study of Contraction-Movement Relationships in the Tennis Stroke, An. Arthur T. Slater-Hammel. 4:424.
- Influence of Athletic Success and Failure on the Level of Aspiration. Carnie H. Smith. 2:196.
- Study of Existing State High School and Other Selected Athletic Benefit Plans, A. Walter E. Marks. 4:406.

Basic Walking Load Involved in Attending the University as Measured by a Pedometer: I. The Walking Load of College Women, The. Dorothy G. Copony and Roland Rooks. 2:209.

Condition Ratings and Endurance Measures. Franklin M. Henry and Daniel S. Farmer. 2:126.

COPONY, Dorothy G., and Roland Rooks. The Basic Walking Load Involved in Attending the University as Measured by a Pedometer: I. The Walking Load of College Women. 2:209.

CORNISH, Clayton. A Study of Measurement of Ability in Handball. 2:215.

COZENS, Frederick W., and Florence Stumpf. Some Aspects of the Role of Games, Sports, and Recreational Activities in the Culture of Modern Primitive Peoples: II. The Fijians. 1:2.

CURETON, T. K. Doctorate Theses Reported by Graduate Departments of Health, Physical Education, and Recreation, 1930-1946, Inclusively. 1:21.

Development of a Test of Badminton Playing Ability, The. Aileene Lockhart and Frances A. McPherson. 4:402.

Development of Personnel Standards for Leadership Duties in Public Recreation, The. Jackson M. Anderson. 3:273.

Doctorate Theses Reported by Graduate Departments of Health, Physical Education, and Recreation, 1930-1946, Inclusively. T. K. Cureton. 1:21.

Effect of Smoking Upon Recuperation from Local Muscular Fatigue. Hector W. Kay and Peter V. Karpovich. 3:250.

Effect of Water Ingestion on Capacity for Exercise. C. C. Little, H. Strayhorn, and A. T. Miller, Jr. 4:398.

ELBEL, Edwin R., and Robert M. Holmer. The Relationship Between Pre-Exercise Pulse Rate and Recovery Following Exercise. 4:367.

Factor Analysis of Motor Learning, A. L. W. McCraw. 3:316.

FARMER, Daniel S., and Franklin M. Henry. Condition Ratings and Endurance Measures. 2:126.

FRENCH, Esther, and Evelyn Stalter. Study of Skill Tests in Badminton for College Women. 3:257.

HAPP, William P., W. W. Tuttle, and Marjorie Wilson. The Phys-

iologic Effects of Abdominal Cold Packs. 2:153.

HENRY, Franklin M., and Daniel S. Farmer. Condition Ratings and Endurance Measures. 2:126.

HEWITT, Jack E. Achievement Scale Scores for High School Swimming. 2:170.

HISTORY

Some Aspects of the Role of Games, Sports, and Recreational Activities in the Culture of Modern Primitive Peoples: II. The Fijians. Florence Stumpf and Frederick W. Cozens. 1:2.

Survey of Research in the Teaching of Sports, A. Robert T. Kretchmar, Hayt Sherman, and Ross Mooney. 3:238.

HOLMER, Robert M., and Edwin R. Elbel. The Relationship Between Pre-Exercise Pulse Rate and Recovery Following Exercise. 4:367.

HUBBEL, Josephine W. Specific and Non-Specific Exercises for the Relief of Dysmenorrhea. 4:378.

Influence of Athletic Success and Failure on the Level of Aspiration. Carnie H. Smith. 2:196.

JOHNSON, Ralph H. Selection of Men Students for Professional Training in Physical Education. 3:307.

JOHNSON, Warren R. A Study of Emotion Revealed in Two Types of Athletic Contests. 1:72.

JOKL, Ernst. Medical Research in Physical Education in South Africa. 1:88.

KARPOVICH, Peter V., and Hector W. Kay. Effect of Smoking Upon Recuperation from Local Muscular Fatigue. 3:250.

KAY, Hector W., and Peter V. Karpovich. Effect of Smoking Upon Recuperation from Local Muscular Fatigue. 3:250.

KRETCHMAR, Robert T., Hoyt Sherman, and Ross Mooney. A Survey of Research in the Teaching of Sports. 3:238.

LARSON, Leonard A. The Major Problems of College Physical Education, 1949. 4:387.

LINDEBURG, Franklin A. A Study of the Degree of Transfer Between Quickening Exercises and Other Coordinated Movements. 2:180.

LITTLE, C. C., H. Strayhorn, and A. T. Miller, Jr. Effect of Water Ingestion on Capacity for Exercise. 4:398.

LOCKHART, Aileene, and Frances A. McPherson. The Development of a Test of Badminton Playing Ability. 4:402.

Major Problems of College Physical Education, 1949, The. Leonard A. Larson. 4:387.

MARKS, Walter E. A Study of Existing State High School and Other Selected Athletic Benefit Plans. 4:406.

MATTHEWS, Helen, and M. Gladys Scott. A Study of Fatigue Effects Induced by an Efficiency Test for College Women. 2:134.

McCRAW, L. W. A Factor Analysis of Motor Learning. 3:316.

McKEE, Robert, and G. Lawrence Rarick. A Study of Twenty Third-Grade Children Exhibiting Extreme Levels of Achievement on Tests of Motor Proficiency. 2:142.

McPHERSON, Frances A., and Aileene Lockhart. The Development of a Test of Badminton Playing Ability. 4:402.

Medical Research in Physical Education in South Africa. Ernst Jokl. 1:88.

MILLER, A. T., Jr., C. C. Little, and H. Strayhorn. Effect of Water Ingestion on Capacity for Exercise. 4:398.

Mental Practice and Physical Practice in Learning a Motor Skill. 4:432.

MISCELLANEOUS

Doctorate Theses Reported by Graduate Departments of Health, Physical Education, and Recrea-

tion, 1930-1946, Inclusively. T. K. Cureton. 1:21.
Major Problems of College Physical Education, 1949, The. Leonard A. Larson. 4:387.
Personality of Weightlifters. John B. Thune. 3:296.
MOFFETT, Donovan D. A Survey of Teachers' Needs in Health Education, Physical Education, and Recreation. 4:417.
MOONEY, Ross, Robert T. Kretchmar, and Hoyt Sherman. A Survey of Research in the Teaching of Sports. 3:238.
NEMSON, Edward. Specific Annoyances in Relation to Student Attitude in Physical Education Classes. 3:336.
Personality of Weightlifters. John B. Thune. 3:296.
PHILLIPS, Marjorie. Study of a Series of Physical Education Tests by Factor Analysis. 1:60.

PHYSICAL EDUCATION

Specific Annoyances in Relation to Student Attitude in Physical Education Classes. Edward Nemson. 3:336.
Study in Acquaintanceship and Social Status in Physical Education Classes, A. Elvera Skubic. 1:80.
Physiologic Effects of Abdominal Cold Packs, The. William P. Happ, W. W. Tuttle, and Marjorie Wilson. 2:153.

PHYSIOLOGY

Basic Walking Load Involved in Attending the University as Measured by a Pedometer: I. The Walking Load of College Women, The. Dorothy G. Copony and Roland Rooks. 2:209.
Condition Ratings and Endurance Measures. Franklin M. Henry and Daniel S. Farmer. 2:126.
Effect of Smoking Upon Recuperation from Local Muscular Fatigue. Hector W. Kay and Peter V. Karpovich. 3:250.
Effect of Water Ingestion on Capacity for Exercise. C. C. Little, H. Strayhorn, and A. T. Miller, Jr., 4:398.
Medical Research in Physical Education in South Africa. Ernst Jokl. 1:88.
Physiologic Effects of Abdominal Cold Packs, The. William P. Happ, W. W. Tuttle, and Marjorie Wilson. 2:153.
Relationship Between Pre-Exercise Pulse Rate and Recovery Following Exercise, The. Edwin R. Elbel and Robert M. Holmer. 4:367.
Specific and Non-Specific Exercise for the Relief of Dysmenorrhea. Josephine W. Hubbell. 4:378.
Study of Emotion Revealed in Two Types of Athletic Contests, A. Warren R. Johnson. 1:72.
Study of Fatigue Effects Induced by an Efficiency Test for College Women, A. M. Gladys Scott and Helen Matthews. 2:134.

PROFESSIONAL EDUCATION

Selection of Men Students for Professional Training in Physical Education. Ralph H. Johnson. 3:307.
Survey of Teachers' Needs in Health Education, Physical Education, and Recreation, A. Donovan C. Moffett. 4:417.
RARICK, G. Lawrence, and Robert McKee. A Study of Twenty Third-Grade Children Exhibiting Extreme Levels of Achievement on Tests of Motor Proficiency. 2:142.

RECREATION

Development of Personnel Standards for Leadership Duties in Public Recreation, The. Jackson M. Anderson. 3:273.
Relationship Between Pre-Exercise Pulse Rate and Recovery Following Exercise, The. Edwin R. Elbel and Robert M. Holmer. 4:367.

RESEARCH ABSTRACTS
1:110; 2:223; 3:348; 4:436.
ROOKS, Roland, and Dorothy G. Copony. The Basic Walking Load Involved in Attending the University as Measured by a Pedometer: I. The Walking Load of College Women. 2:209.
SCOTT, M. Gladys, and Helen Matthews. A Study of Fatigue Effects Induced by an Efficiency Test for College Women. 2:134.
Selection of Men Students for Professional Training in Physical Education. Ralph H. Johnson. 3:307.
SHERMAN, Hoyt, Robert T. Kretchmar, and Ross Mooney. A Survey of Research in the Teaching of Sports. 3:238.
SKUBIC, Elvera. A Study in Acquaintanceship and Social Status in Physical Education Classes. 1:80.
SLATER-HAMMEL, Arthur T. An Action Current Study of Contraction-Movement Relationships in the Tennis Stroke. 4:424.
SMITH, Carnie H. Influence of Athletic Success and Failure on the Level of Aspiration. 2:196.
Some Aspects of the Role of Games, Sports, and Recreational Activities in the Culture of Modern Primitive Peoples: II. The Fijians. Florence Stumpf and Frederick W. Cozens. 1:2.
Specific and Non-Specific Exercises for the Relief of Dysmenorrhea. Josephine W. Hubbell. 4:378.
Specific Annoyances in Relations to Student Attitude in Physical Education Classes. Edward Nemson. 3:336.
STALTER, Evelyn, and Esther French. Study of Skill Tests in Badminton for College Women. 3:257.
STRAYHORN, H., A. T. Miller, Jr., and C. C. Little. Effect of Water Ingestion on Capacity for Exercise. 4:398.
Study of Acquaintanceship and Social Status in Physical Education Classes, A. Elvera Skubic. 1:80.
Study of a Series of Physical Education Tests by Factor Analysis. Marjorie Phillips. 1:60.
Study of Emotion Revealed in Two Types of Athletic Contests, A. Warren R. Johnson. 1:72.
Study of Existing State High School and Other Selected Athletic Benefit Plans, A. Walter E. Marks. 4:406.
Study of Fatigue Effects Induced by an Efficiency Test for College Women, A. M. Gladys Scott and Helen Matthews. 2:134.
Study of Measurement of Ability in Handball, A. Clayton Cornish. 2:215.
Study of Skill Tests in Badminton for College Women. Esther French and Evelyn Stalter. 3:257.
Study of the Degree of Transfer Between Quickening Exercises and Other Coordinated Movements, A. Franklin A. Lindeburg. 2:180.
Study of Twenty Third-Grade Children Exhibiting Extreme Levels of Achievement on Tests of Motor Proficiency, A. G. Lawrence Rarick and Robert McKee. 2:142.
STUMPF, Florence, and Frederick W. Cozens. Some Aspects of the Role of Games, Sports, and Recreational Activities in the Culture of Modern Primitive Peoples: II. The Fijians. 1:2.
Survey of Research in the Teaching of Sports, A. Robert T. Kretchmar, Hoyt Sherman, and Ross Mooney. 3:238.
Survey of Teachers' Needs in Health Education, Physical Education, and Recreation, A. Donovan C. Moffett. 4:417.

TESTING
Achievement Scale Scores for High School Swimming. Jack E. Hewitt. 2:170.
Development of a Test of Badminton Playing Ability, The. Aileene

Lockhart and Frances A. McPherson. 4:402.
Factor Analysis of Motor Learning, A. L. W. McCraw. 3:316.
Mental Practice and Physical Practice in Learning a Motor Skill. Wilbur E. Twining. 4:432.
Study of a Series of Physical Education Tests by Factor Analysis. Marjorie Phillips. 1:60.
Study of Measurement of Ability in Handball, A. Clayton Cornish. 2:215.
Study of Skill Tests in Badminton for College Women. Esther French and Evelyn Stalter. 3:257.
Study of Degree of Transfer Between Quickening Exercises and Other Coordinated Movements, A. Franklin A. Lindeburg. 2:180.
Study of Twenty Third-Grade Children Exhibiting Extreme Levels of Achievement on Tests of Motor Proficiency, A. G. Lawrence Rarick and Robert McKee. 2:142.
THUNE, John B. Personality of Weightlifters. 3:296.
TUTTLE, W. W., William P. Happ, and Marjorie Wilson. The Physiologic Effects of Abdominal Cold Packs. 2:153.
TWINING, Wilbur E. Mental Practice and Physical Practice in Learning a Motor Skill. 4:432.
WILSON, Marjorie, William P. Happ, and W. W. Tuttle. The Physiologic Effects of Abdominal Cold Packs. 2:153.